# AIR CONDITIONING HEATING AND VENTILATING

AUGUST, 1955 – 52nd YEAR

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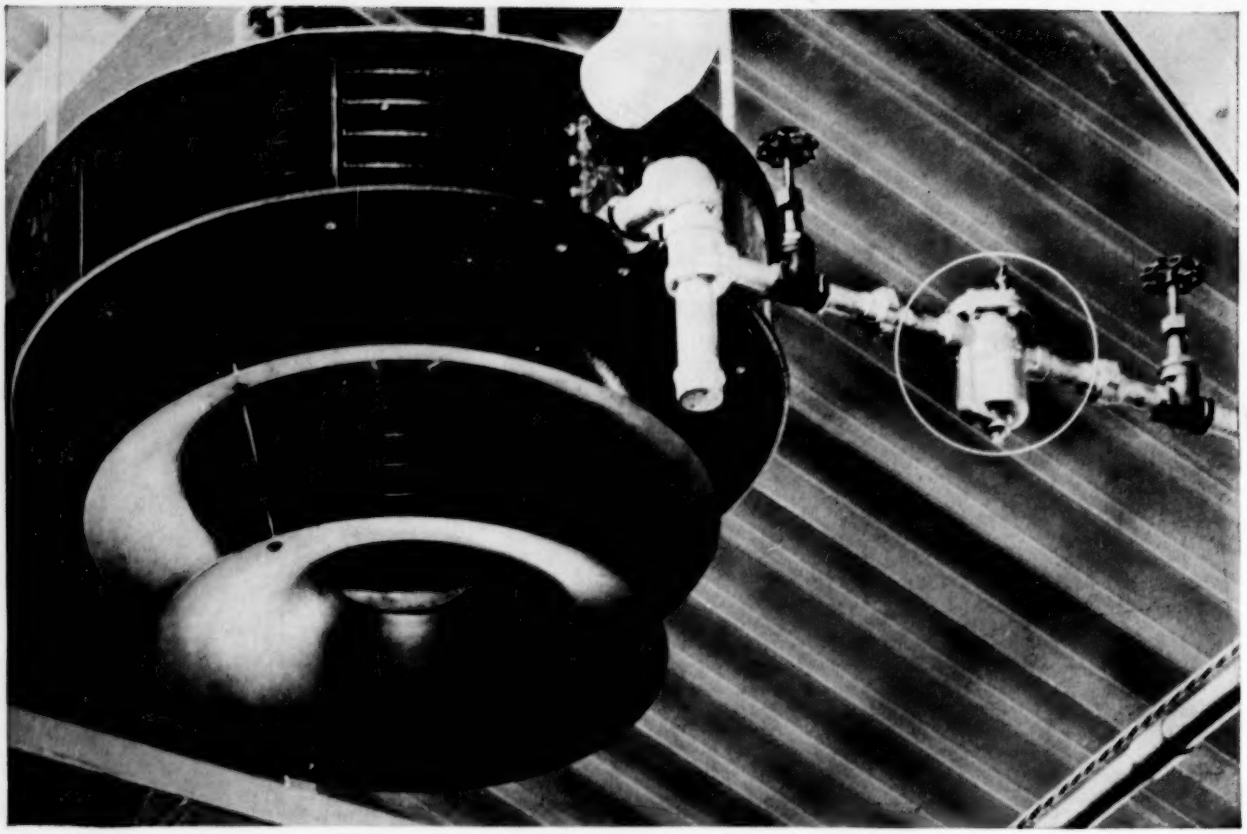

# Here's the Way to Trap a Unit Heater for Lots of Heat and Little Maintenance

The picture above is an outstanding guide to good unit heater trapping. This installation provides maximum heater efficiency and minimum maintenance time and cost.

**1. Simplified piping.** Horizontal in-line piping is made possible by the Armstrong side inlet—side outlet trap body. Note that the trap can be opened by removing the cap, without disturbing pipe connections.

**2. Dirt pocket ahead of trap.** The vertical pipe leg collects heavy dirt and scale. No strainer is needed because the self-scrubbing action of an Armstrong trap washes ordinary dirt right through it.

**3. Test valve.** The maintenance engineer can check this trap quickly and easily by opening the test cock shown installed in the trap cap.

**4. Shut-off valves and unions.** The trap can be repaired, or replaced with a spare trap, without shutting off any other units.

**5. Generous sized trap.** The Armstrong trap, selected from Table B-29 or C-29 in The Armstrong Steam Trap Book, provides a minimum safety factor of 3 to 1 for this job. Its big air handling capacity keeps the heater free of corrosion-producing air and $CO_2$, provides fast heat-up and full rated btu output. No lag—condensate is discharged at steam temperature.

**6. A good steam trap.** The Armstrong trap discharges condensate at steam temperature and it has large air venting capacity. The heater is always full of hot, dry steam.

The Armstrong trap mechanism cannot clog, bind, stick or collapse. Valve and seat are hardened chrome steel—all other working parts are stainless

An Armstrong trap is rated conservatively on a basis of actual hot condensate capacity under job operating conditions. This is not true of all traps and is an important factor when comparing prices.

Armstrong traps are sold by factory-trained Representatives under an unconditional, money-back guarantee of satisfaction to the user.

For the best in unit heater trapping, call your local Armstrong Representative, or write:

**ARMSTRONG MACHINE WORKS**
846 Maple Street • Three Rivers, Michigan

FREE — "How to Trap Unit Heaters" is the title of pages 28 and 29 in The Armstrong Steam Trap Book. This 44-page catalog is a guide to good trapping practice. Send for your copy.

STEAM TRAPS FOR EVERY REQUIREMENT

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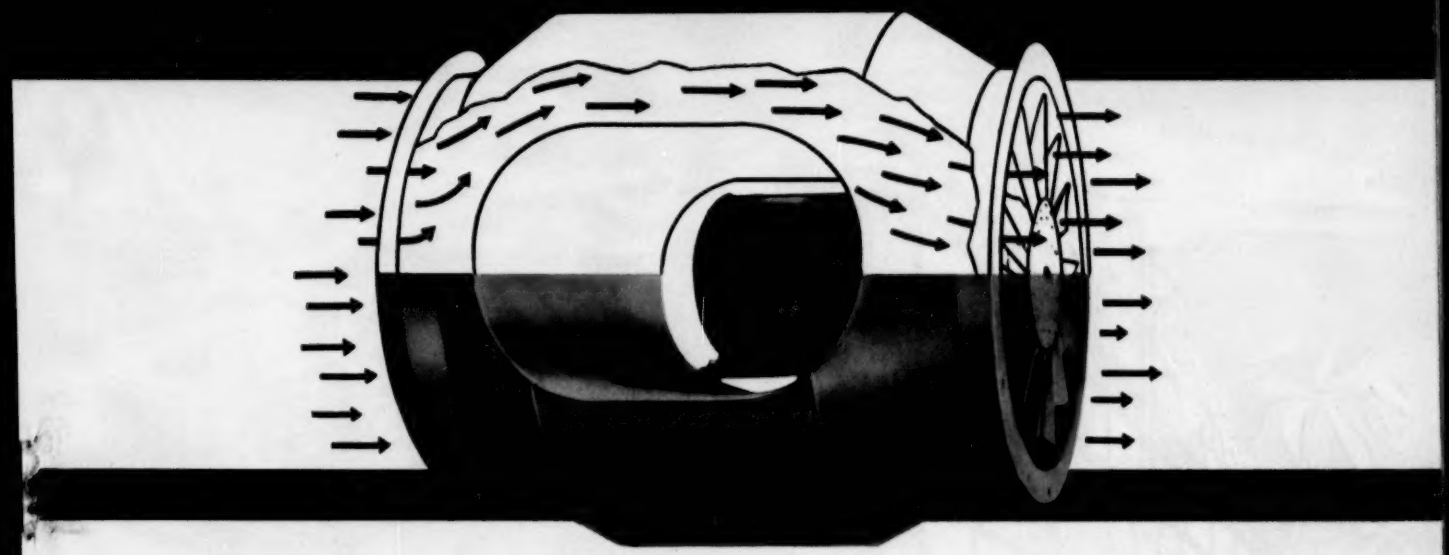

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# EXHAUSTING FUMES THE *DIRECT WAY*

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Reserve your copy of this new Bifurcator® Fan catalog now being printed. The catalog goes into detail on the *direct* way in which the Bifurcator Fan exhausts fumes . . . and also includes the latest improvements made in the Bifurcator Fan itself. This catalog is packed with up-to-date information on Bifurcator sizes and capacities, dimensions, volume and pressure fan wheels, protection against corrosion, and certified capacity ratings.

You'll also find data that's handy in solving many a ventilation problem. For in the catalog is helpful fan information like . . .

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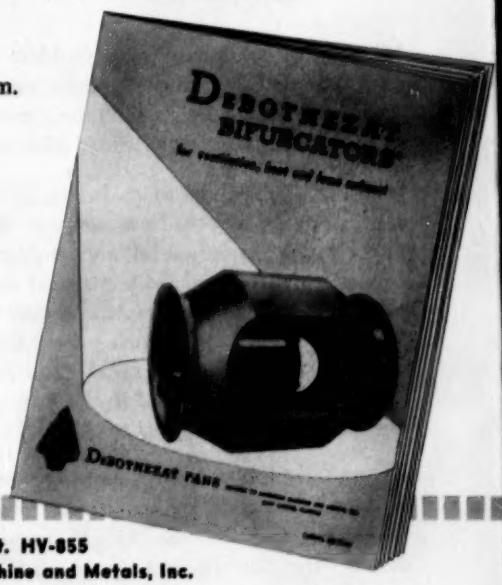
- how to determine static pressure
- velocity pressure table
- friction chart
- loudness level table

***So be sure to reserve your copy by mailing the coupon.***

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American Machine and Metals, Inc.

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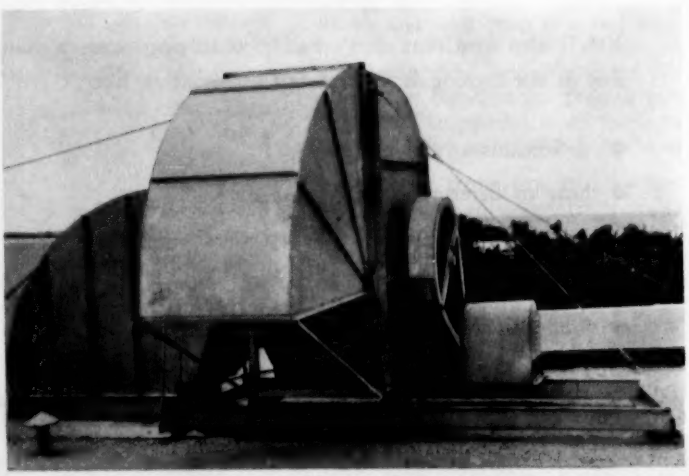
"Buffalo" Fans help to maintain these ideal air conditions, as they do in so many of the country's finest hotels, commercial and public buildings. Credit for this beautifully planned and executed project is well earned by: *Mechanical Contractors Supply, Inc., air conditioning contractors; Taylor Construction Corp., general contractors; Igor Polevitzky, architect; and Rader Engineering Co., mechanical engineers, all of Miami, Fla.*

For any air job you are planning, insure its finished performance by specifying "Buffalo", the fans with the famous "Q" Factor* built into them — the fans backed by 78 years of quality manufacture.



ROOF EXHAUST FOR COOL COMFORT BELOW! One of the "Buffalo" Type BL Limit-Load Ventilating Fans on roof exhaust service at the Golden Gate Hotel. For details on these extremely quiet, efficient fans, write for Bulletin F-100.

**The "Q" Factor — the built-in-Quality which provides trouble-free satisfaction and long life.*

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# AIR CONDITIONING HEATING AND VENTILATING

AUGUST, 1955

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VOL. 52 No. 8

**Published by**
THE INDUSTRIAL PRESS

Executive, Editorial and Subscription Offices,
93 Worth St.,
New York 13, N. Y.

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**The Cover:** Fan located directly below roof exhaust from Petroleum Research Laboratory, Carnegie Institute of Technology, Pittsburgh, Pa. Photograph, courtesy Westinghouse Electric Corp.

**AIR CONDITIONING, HEATING AND VENTILATING,** published monthly by The Industrial Press, 116 Main St., Norwalk, Conn. Executive, editorial and subscription offices, 93 Worth St., New York 13, N. Y. Entered as second-class matter, February 16, 1954, at the Post Office, Norwalk, Conn., under Act of March 3, 1879. Printed by O'Brien Suburban Press, Norwalk.

**Subscription Rates:** In the United States and Canada, one year, $3; two years, $5; three years, $6; in all other countries, one year, $7; two years, $11. Single copies, 30 cents.

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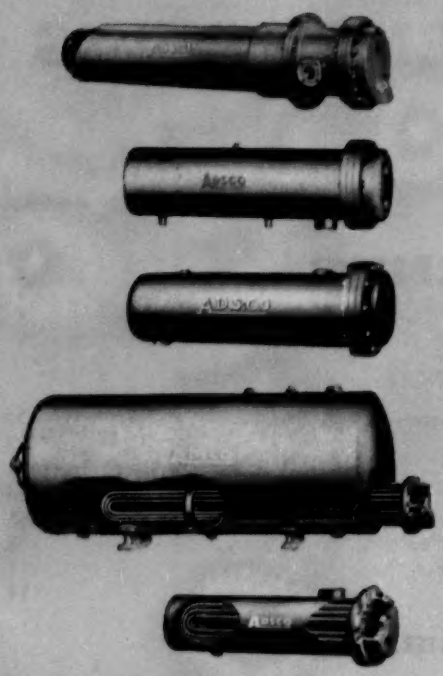
**Indexing and Microfilm:** Contents of AIR CONDITIONING, HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and microfilmed by University Microfilms, Ann Arbor, Mich.

# SAVE

## WITH THESE STANDARD DESIGNS



### ● TANK SUCTION HEATERS

Viscosity of heavy oils and other liquids is reduced so they can be pumped economically. Only liquid to be pumped is heated, eliminating steam waste. Furnished with nozzle for welding into storage tanks or with flange for bolting to existing flanged nozzle.

### ● OIL PRE-HEATERS

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As condensate cooler or waste-heat reclaimer, this equipment effects substantial savings. Of steel-shell construction with removable U-tubes. Condensate may be passed through either tubes or shell.

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Any plant with a good steam supply can advantageously use these heaters. For heating water for process work or for showers and washrooms. As convertors, these heaters are used for space heating. Of simple U-bend design with removable element.

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Drawing on its long and varied experience in manufacturing heat exchangers, ADSCO has now standardized the designs of many of its heaters and coolers. In this standardization program, production costs have been reduced, while the performance ability of the exchangers has been maintained. The result is the same high ADSCO value with the benefits of standardization passed along to customers.

ADSCO also builds heat exchangers to customers' requirements, such as: lube oil coolers, suction oil heaters, pre-heaters, jacket water coolers, vapor condensers, feed-water heaters, boiler blow-down heaters, and many others. Shells and tubes in all metals. Units may be performance-tested in ADSCO laboratories, if customer desires. Exchangers are made to ASME and API-ASME codes and to TEMA Specifications.

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# HIGH SPOTS

**A Division of Civilian Application** has been established in the Atomic Energy Commission staff, with Harold L. Price as director. The new division is responsible for developing AEC regulations and instructions dealing with licenses, authorizations, and other activities related to civilian use.

**Construction industry** operated at record levels during the first half of 1955, with no sign of a downturn. Dodge mid-year review points to high levels in every category. See news department.

**Federal research in air polution** and technical assistance in air polution problems was urged in a June report by a special committee of the Department of Health, Education, and Welfare. The committee was composed of representatives of various government departments and was under chairmanship of Surgeon General Scheele. Authorizing legislation was recommended with the suggestion that the problem be administered by the Department of Health, Education, and Welfare assisted by a permanent interdepartmental committee.

**Objection** to federal activity in air polution was registered by the Coal Producers Committee for Smoke Abatement, who cited a survey showing that 67% of major corporations throughout the country believe the problem should be handled by industry alone or in conjunction with state or local governments.

**Present status of atomic power** was summarized by Louis H. Roddie, Jr., deputy director of the AEC Division of Reactor Development, who pointed out that in 1947 only about 50 people were working on the problem of atomic power, whereas today there are in excess of 5,000 scientists and engineers working in that field. Potential for the future was indicated by the observation that this number represents less than 1% of the total of such personnel working in research and development in this country.

**Central residential air conditioning** equipment sales were estimated at 150,000 units for the year by Cloud Wampler, president of Carrier. This is an increase over a prior estimate of 125,000 units made a few months ago. Sales for 1954 were about 75,000 units.

**The largest boiler in the world** will be made by Babcock and Wilcox to produce 2,400,000 pounds of steam per hour for Consolidated Edison's Astoria plant in Queens, N. Y. Erection of the boiler will start in early 1957, and it will begin generating between 300,000 and 357,000 kw in the fall of 1958. It will be equipped to burn either coal, oil, or natural gas.

**VA appraisal requests** on proposed GI homes dropped 25% in June, while requests for appraisal on existing homes showed only a slight decline. Applications for GI home loan guaranty topped 50,000 for the 11th straight month.

**A solar furnace,** first in New York City, was constructed from the reflector of a surplus Army searchlight, by Dr. Tibor S. Laszlo of Fordham University. In a June demonstration it melted granite and can develop a temperature in a dime-size spot of about 6,000 deg F.

**Anthracite mine drainage** will be paid for by state and federal funds in accordance with a bill signed in July by President Eisenhower. The bill (H.R. 7066) provides for the expenditure of $8.5 million of federal funds to be matched by a like amount of state funds for flood control and anthracite mine drainage.

# WASHINGTON OVERTONES

by LORING OVERMAN

**International Diplomacy and Congressional Adjournment** plans shared the attention of official Washington during mid-July.

Win, lose or draw in Geneva, the Big Four conference will sound important overtones in this country. If the President and his party conclude that peace overtures are real enough to justify curtailing armaments, the pattern of U. S. prosperity will change. There seems to be no reason for a change in the fabric; merely in the pattern.

Defense industries, for example, deprived of some of their markets for weapons, will turn to civilian production. Result to civilians: more consumer goods at lower prices. If the peace gestures are interpreted as mere balks, expect continued arms production; continued tension, inflation, taxation.

**Meanwhile Congress,** with none of the Big Four cards yet shown, did its pre-adjournment planning on a pre-Geneva basis. Many of its last-minute conclusions . . . as well as the actions of Washington agencies, affect the folks concerned with air-conditioning, heating, and ventilating. Let's look:

**Defense Moves** included:

• **Rough time for WOC's**—industry men serving without compensation, on loan from their own companies for six month periods. Senate, anxious to make an "example" of alleged irregular practices among WOC's, included in new Defense Production Act extension, a prohibition against industry people in policy-making positions.

At presstime for this column, Congress appeared ready to concede the WOC's were essential, but that safeguarding legislation would be helpful. Suggested were provisions barring WOC's from negotiating contracts with companies employing them, and a stipulation that WOC's may not make policy decisions, but may act in an advisory capacity to full-time government employees.

• President Eisenhower signed HR 6042, appropriating $31.8 billion to operate the **Defense Department.** He protested two riders, urging Congress to repeal them. One, which he believes unconstitutional, gives Congress a veto power over efforts of the Defense Department to divest itself of certain commercial-type operations which could be performed by private companies. Another bans foreign-made spun silk yarn for cartridge cloth.

• House and Senate Conference Committee agreed to extend the **Renegotiation Act** of 1951 for two years; to December 31, 1956.

• Defense Secretary Charles E. Wilson, in a new directive, has **redefined responsibilities** of the Military Departments for public works construction. Army is to employ Corp. of Engineers; Navy, Bureau of Yards and Docks; Air Force, both. The directive further authorizes the Department of the Air Force to design and construct (1) research and test facilities peculiar to aircraft development, and (2) other projects approved by the Secretary of Defense.

• Fast action by the Senate (an 80 to 1 roll call vote) virtually assured passage of the President's Armed Forces Reserve Bill. One provision is of interest to all employers. It would permit young men of 17 to 20 to volunteer for six months of active duty, followed by 7½ years' service in an active reserve unit. Such a plan would pose new employment problems—vacations, time off with or without pay, and so on.

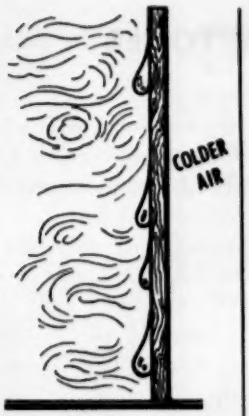
**Fuels** came in for a certain amount of attention this past month in Washington.

• House Appropriations Committee ordered the Bureau of Mines to **close its oil-shale plant** at Rifle, Colo. Committee refused $1,250,000 to continue the plant; voted $625,000 to place it in standby condition. House group explained, "it is the committee's opinion that continuation of government-financed research in this field is not now justified in view of industry's readiness to proceed with oil-shale development work."

(*Continued on page* 8)

# How to Reduce CONDENSATION!

## Prevent Damage to Wood, Plaster, Paint, etc.




Condensation forms when temperature of contacting air is reduced below dew-point by a cold surface.

Condensation forms when the capacity of an air space at a given temperature is too small for the amount of vapor present. →

As air becomes colder, it can hold less vapor in suspension. The degree of saturation increases until a dew-point is reached and condensation occurs.

Heat flows from warm to cold by conduction. A material which is in contact with air colder than itself on one side and air warmer than itself on the other side, will *continuously* extract heat from the warmer air by conduction and lose it to the colder air. As the contacting warmer air becomes cooler by this action, the amount of vapor it can hold in suspension without condensing becomes smaller.

The denser and bulkier the material, the more heat it can extract before attaining room temperature, if it *ever* does. The scientific construction of multiple layers of accordion aluminum, fiber and air spaces minimizes condensation formation on or within this type of insulation, when installed in building spaces.

### THE REASON CONDENSATION IS MINIMIZED

Since the sheet of aluminum adjacent to the warm, inner air of a building weighs only about ¼ oz. per sq. ft., it does not need to extract much heat from that air to attain and remain at room temperature. Since the emissivity of the aluminum surface is only 3%, little heat is lost by radiation and this further enables the aluminum to remain at about room temperature and not extract much heat from that warmer air.

Since the other sheets of aluminum and fiber retard heat flow by inner as well as outer convection, and since conduction is slight through the preponderant low density air spaces, the sheet's other surface faces a space which is only a *little* colder than the aluminum itself. But because warmth flows to cold in conduction, the aluminum will *give off a slight* amount of *heat* to the colder space, thereby slightly *increasing* the vapor retaining capacity of that space. The successive reflective spaces and sheets of aluminum and fiber behave similarly. Since each aluminum surface is slightly warmer than the air it faces on its cold side, there is no extraction of heat *(The reverse is true.)*

### CONTINUOUS VAPOR BARRIER

When multiple accordion aluminum is used, fortuitous vapor and water (like rain) which intrude into building spaces will, as the vapor pressure develops therein, gradually flow out as vapor through exterior walls and roofs because vapor flows from areas of greater to less density. Since the vapor cannot back up through the continuous, almost impervious aluminum, it will flow out because exterior walls and roofs have substantial permeability in comparison with the aluminum, far greater than the required 5:1 ratio.

Of great importance is the use of a continuous metallic vapor barrier of almost zero water vapor permeability, without "breaks" every few feet, to retard the outward flow of vapor which originates inside the house. Infiltration under the flat stapled flanges of multiple accordion aluminum is slight.

To obtain MAXIMUM, *uniform-depth* protection against heat loss and condensation formation, it is necessary to use the new edge-to-edge multiple aluminum*, each sheet of which stretches from joist to joist.

The U. S. Bureau of Standards has prepared a helpful and informative booklet, "Moisture Condensation in Building Walls," which discusses causes and cures. Use the coupon to get a free copy from us.

*Patent applied for.

**COST OF EDGE-TO-EDGE INFRA**
**Multiple Aluminum Insulation installed in new construction between wood joists, material and labor**
**Type 6-PS about 10¢ sq. ft.**
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## WASHINGTON OVERTONES (*Continued from page 6*)

**Construction** continued to be one of the brighter spots in the economy. HHFA Administrator Albert M. Cole, at a special press conference in mid-July:

- **Denied** rumors he may be planning to leave Government to take a position with private industry.
- Forecast Congress would pass a **public housing bill** trimmed to the President's request for 35,000 units per year for two years. Senate-passed bill calls for more than 200,000 units.
- Predicted 1.2 million **housing starts** in 1955.
- Said he expects no lessening of interest by cities in attacking problems of **urban blight.**

Echoing the HHFA Director's enthusiasm, the National Association of Real Estate Boards announced a blight elimination program under the slogan, **No slums by 1969.**

NAREB President Henry G. Waltemade says the program is "reasonable, attainable." Said several cities are already working at a rate which will make them free of health, safety and sanitary hazards within five years. **Example:** Los Angeles, New Orleans, Pasadena, Kansas City, Charlotte, N. C. **Impressive Headway:** Chicago, New York, Cincinnati, Corpus Christi, Detroit, Durham, Philadelphia, Portland, Me., San Francisco.

- NAREB estimates, based on Census bureau figures, as high as $12 billion a year may now be going into **home improvements and repairs,** some due to action of housing code officials, many voluntary.
- Morton Saber, chief, Rehabilitation Department, National Association of Home Builders, said several major industries may join in fight to **eliminate slums.** Some, he said, are urging establishment of housing centers to lead the move. Proposed are permanent staffs under advisory committees of builders, realtors and civic leaders.
- Construction totals were expected to set new records in July—well above the all-time June record of $3.8 billion. Encouraging to air conditioning people—commercial expenditures for June were up 15% from May; industrial, up 17%; school building up 19%. June total, adjusted seasonally, was at rate of $41.9 billion a year.

**About Smog Prevention.** More work for smoke-control engineers is forecast in Senate Bill 928. Provides $5 million yearly for five years to research methods of combatting air pollution. House-amended version of Senate-passed bill seemed likely to beat adjournment deadline. Welfare Secretary would direct program, with Surgeon General's office as clearing house for data.

**Biggest news** at Washington headquarters of Air Conditioning and Refrigeration Institute involved:

- Likelihood of **new sales record** for room air conditioners this season. Sales through June were slightly ahead of the first half of '54; then came a national heat wave. Result: demand skyrocketed, and a record year is in sight.
- Further step toward more room air conditioner sales . . . possible **reduction in excise tax.** ACRI officials were hopeful Congress would pass HR 6105, introduced by Congressman Eugene J. McCarthy (D., Minn.). This bill, and a similar one by Representative Schenk (R., Ohio) would return room air conditioners to the list of home appliances carrying 5% excise tax. Present levy is 10%. Inequity of present levy is conceded by Congress; catch is time required to gear such a relatively small change to the ponderous machine of tax legislation.

Conferences at **Federal Trade Commission** offices in Washington on June 22:

- Indicated that industry and government are still a long way from agreement on proposed **Fair Trade Practice** rules applying to air conditioning. The conference in June followed a similar one May 20 in Chicago.
- Pending further study of the overall problem, the industry has announced **room air conditioning standards** without FTC blessing. Developed jointly by ACRI and the National Better Business Bureau, purpose of the standards is to eliminate public confusion about the cooling capacity of room conditioners.

# Brunner makes only square pegs for square holes

. . . and round pegs for round holes, too! Brunner's wide range of refrigeration equipment makes it possible for your customers to have the right type and size of units for their specific refrigeration requirements. They don't need to settle for something that's either too large or too small for the job.

You can sell Brunner with full confidence that your customers are getting the *right* unit for the *right* job . . . the most dependable refrigeration that money can buy.

**"BRUNNER" MEANS BIGGER PROFITS FOR YOU**

The completeness of the Brunner line opens the door to bigger profits for you. There are Brunner Refrigeration Condensing Units for every commercial and industrial application . . . big or small.

They're noted for dependability . . . durability . . . easy installation and maintenance . . . and they cost less to operate than many other units of similar capacities.

See your Brunner Representative, or write to:

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The Brunner Co., Gainesville, Ga.
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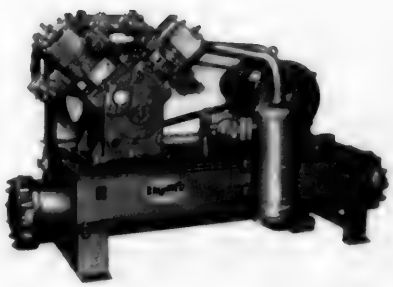

**BRUNNER CONDENSING UNITS**
. . . range from ⅛ H.P. to 75 H.P. for high, medium, low and extremely low temperature work. They're easy to install . . . easy to service on the job!

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SINCE 1906

**BRUNNER EXTRAS**

Compressor Experience
Product Research
Design Engineering
Wide Product Range
Proven Quality
Complete Dependability
Easy Servicing
Warranted Performance
Nearby Distributor Service
Profit Opportunity
Advertising Support
Sales Promotion Help

# BRIEFLY STATED

• William J. Millett has been appointed assistant vice president in charge of manufacturing of Worthington Corporation's Air Conditioning and Refrigeration Division. Mr. Millett, who has been with Worthington for the past 42 years, was formerly works manager at the Holyoke Plant.

• A. B. Kennison, of Plainfield, N. J., one of the nation's top consultants in the field of product design, has been elected a vice-president of Servel, Inc., and will serve as the company's coordinator of research and product development.

• Clyde H. Wilkinson has been appointed manager, water heater products, for the Plumbing and Heating Division of American-Standard. Prior to assuming his present position, he was manager, water heaters, for the Bryant Division of the Carrier Corp., Cleveland, and also was chairman of its Gas Industry Development Coordination Committee.

• Perfection Industries, Inc., announces that, starting immediately, its appliance and furnace sales divisions will be headed by Donald G. Wright, as general sales manager. He assumes the duties of J. H. Rasmussen who has retired as vice-president and director of appliance sales. Phillip J. White has been named sales manager of Perfection's refrigeration contract division. For the past three years he has been sales manager of the refrigeration products division of the Hupp Corp., whose central air conditioning business has been purchased by Perfection. Mr. Wright, since 1953 has been general manager of the Globe Stamping and Refrigeration Products Division of the Hupp Corp. Prior to that, for seven years, he was assistant to the vice-president in charge of manufacturing for the Chrysler Division of Chrysler Corp., in Detroit, Mich.

• Five nationally-known manufacturers of home ventilating fans have formed a new trade institute known as The Home Ventilating Fan Institute, Inc., with Martin H. Young of New York City as attorney and executive secretary. The five manufacturers are: Berns Manufacturing Corp., Fasco Industries, Inc., NuTone, Inc., Pryne & Co., Inc., and Trade-Winds Motorfans, Inc. The new Institute was incorporated under the laws of the State of New York. Its temporary headquarters will be at 19 West 44th Street in New York City, with the possibility that permanent headquarters may be established in Washington, D. C.

• Edmund Claxton, director of research of the Armstrong Cork Co., Lancaster, Pa., has been named president of the Building Research Institute, Washington, D. C., technical society for the building industry, and William Muirhead, president of William Muirhead Construction Co., Durham, N. C., is the new vice-president. The terms of office are from July 1, 1955 to June 30, 1956. William H. Scheick continues as executive director.

• Richard G. Lubinsky, manager of the fan sales department of The Trane Company has been elected to a two-year term on the Board of Dirctors of the National Association of Fan Manufacturers, Inc. In addition to his board responsibilities, Mr. Lubinsky will serve as chairman of the Association's Standards and Statistics Committee. Mr. Lubinsky has also served as chairman of the Association's Engineering Committee.

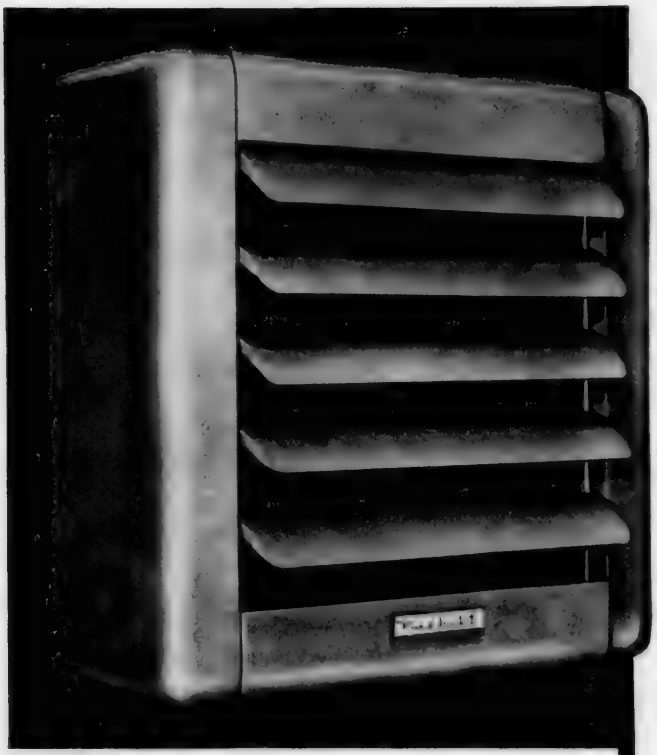
• With a near-record registered attendance of 2,537, the American Society for Testing Materials brought to a close its 58th Annual Meeting at Atlantic City, N. J., on July 1. At the week-long meeting, the Society held 32 technical sessions and approximately 700 technical committee meetings, with as many as 53 meetings being held concurrently. Sixty-six of the Society's technical committees presented reports. Sixty-seven new specifications and methods of test were approved as tentative, and revisions in 351 existing tentatives and standards were acted upon. A total of 119 specifications and methods of test previously designated as tentative were approved for reference to Society letter ballot for adoption as standard; 195 standards were reapproved.

• Charles H. Weaver, who has directed the company's atomic power division since it was organized in 1948, has been elected a vice-president of Westinghouse Electric Corp., with responsibility for all Westinghouse atomic power activities. John W. Simpson, manager of the reactor project for the nation's first full-scale atomic powered electric generating station, has been appointed manager of atomic reactor development activities located at Bettis Field, near Pittsburgh, Pa.

• Philip S. Morris, Minneapolis, Minnesota, submitted his resignation as executive vice-president and director of McQuay Inc., Minneapolis manufacturers of heating, air conditioning, and commercial refrigeration equipment, effective July 31st, 1955. Mr. Morris also resigned as an officer and director of American Automatic Ice Machine Co., a subsidiary of McQuay, effective on the same date. Philip Morris joined McQuay Inc. January 1st, 1947, as assistant to the president and has served as executive vice-president and a director since early 1948. Prior to his association with McQuay, he was executive vice-president of McQuay Aircraft Corp. and Plxweve Manufacturing Co., Los Angeles.

• Karl K. Hilgendorf has been named advertising manager of Cleaver-Brooks Company, Milwaukee, Wis., according to Fred Hainer, executive vice-president. Mr. Hilgendorf, formerly associated with Allis-Chalmers and Johnson Service Co., received his B.A. in Psychology from University of Wisconsin and B.S. in Electrical Engineering from University of Illinois.

• A site near Fruita, in the vicinity of Grand Junction, Colorado, has been announced by the American Gilsonite Co. of Salt Lake City as the location of its proposed processing plant for the production of high octane gasoline and coke. The company earlier had announced its plans for laying a buried 80-mile pipeline from the proposed plant to its mine at Bonanza, Utah, where the unique hydrocarbon mineral, Gilsonite, is extracted.



# new

## propeller-fan unit heaters for steam or hot water . . . without sacrificing capacity

*The first unit heaters rated under new Sound Measurement Test Code of IUHA*

NESBITTS wholly new propeller-fan unit heaters are the first in the field to be tested by the Sound Measurement Test Code adopted this year by the Industrial Unit Heater Association. All units rated within the four lowest sound classifications! Now you can select models with sound emission accurately classified by type of installation—assuring you the most quiet unit for the capacity required.

That's only part of the story. Nesbitt universal heating elements of flat plate-type fins and U-bend coil construction can be used with either steam or hot water (on high temperature drops) *without sacrificing capacity*. Half as many models meet all your needs. Cuts inventory and selection problems in half! Use of low water rates and high temperature drops permits further labor and material savings on hot water installations.

This new Nesbitt line offers an unusual combination of values in construction, performance, appearance and cost. Send for Publication 401.

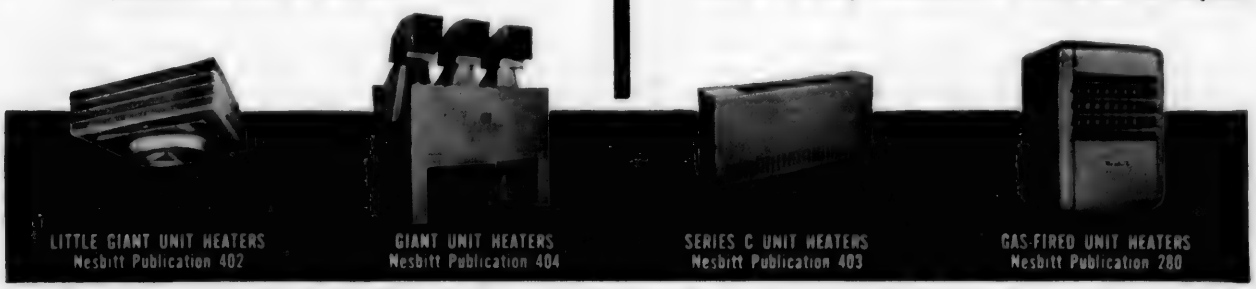
### *plus all these special features:*

- Eight basic unit sizes, 24 models ranging from 15,000 to 335,000 Btu per hour.
- Universal heating elements give maximum performance on either steam or hot water systems.
- U-bend coil construction permits high water capacities and temperature drops.
- Low water rates effect time and material savings in piping and installation.
- Minimum air-flow resistance reduces noise level, lowers operating and maintenance costs.
- Seamless copper condensing tubes and bends; corrugated aluminum fins mechanically bonded.
- Male piping connections extending through casing rear simplify installation and save headroom.
- Accurately balanced aluminum fans for quiet, efficient, large-volume air delivery.
- Rugged, heavy gauge die-formed steel casings are smartly styled for modern interiors.
- Deep drawn air intake opening in rear of casing assures maximum fan performance.
- Easily adjustable discharge louvers; available also with double deflection louvers.
- Attractive green metallic hammered finish is baked on phosphatized steel for long life.

**Nesbitt**

**THE NAME TO GO BUY IN UNIT HEATERS**

**Made by John J. Nesbitt, Inc., Philadelphia 36, Pa.**
**Sold by Leading Wholesalers — Information on Request**



LITTLE GIANT UNIT HEATERS
Nesbitt Publication 402

GIANT UNIT HEATERS
Nesbitt Publication 404

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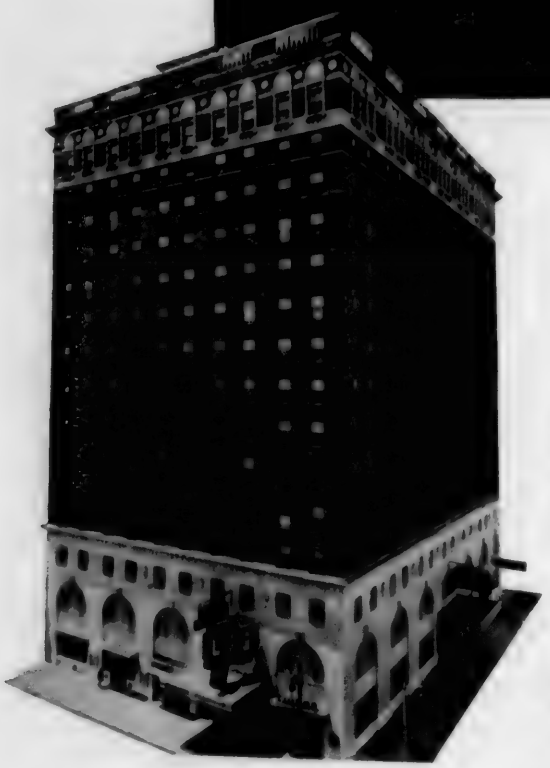
GAS-FIRED UNIT HEATERS
Nesbitt Publication 280



TRADE FRICK MARK

# Air Conditioning

## SERVES THE CLARIDGE HOTEL AT MEMPHIS 21 YEARS!

Back in 1934 the Coffee Shop and Twentieth Century Ball Room at the Claridge were among the first in Memphis to be air conditioned. Two years later a Frick ice-making system was installed, and in 1941 additional cooling capacity for air conditioning. Now the top nine floors have been given the benefit of Frick air conditioning.

What a boon to guests and staff, alike! And what a tribute to Frick equipment, which cools the entire 15-story building! Seven Frick heavy-duty compressors carry the load.

Whether you operate a hotel, restaurant, hospital, store, office, or industrial plant, there's a Frick air conditioning system to meet your exact needs. Also refrigerating, ice making and quick-freezing equipment in all commercial and industrial sizes. Our complete engineering, manufacturing, installation and maintenance service is offered alike to owners and to engineer-contractors. Get literature and estimates now on dependable Frick air conditioning and refrigeration. Visit, phone or write

*Frick Bulletin 504 features general air conditioning; 505 shows engineering details of Frick systems; 522 describes Frick unit air conditioners. See also the Frick pages in Sweet's Catalogs.*

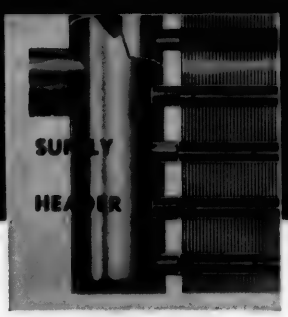
DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

# announcing...

# Nesbitt series T surface with *Trombone* steam distributing tubes




**Eliminates stratification on all surface lengths under reduced steam supply ...assures uniform temperature distribution... improves freeze-up protection**

Trombone shaped tubes offer the most significant improvement in steam distribution since the advent of steam distributing tube surface pioneered and developed by Nesbitt.

With condensing tubes paired in serpentine fashion, the trombone distributing tube (discharging steam through orifices spaced along its entire length) serves two adjacent condensing tubes from a single supply header connection. Steam must traverse the full length of the trombone tube (thus the full length of the surface) before reversing direction, as the demand increases, to serve the second leg of the tube. Even the smallest amounts of steam—*entering only half the conventional number of tubes*—are made to travel *twice* as far across the coil length and to contact *twice* the surface area.

Nesbitt Series T Surface is unmatched for applications requiring uniform steam distribution under modulating valve control (heating and ventilating apparatus), and for those demanding freeze-up protection (preheating).

Available in two types (TS sections have steam and condensate connections at the same end, TO sections at opposite ends), one and two row depths, with aluminum or copper fins, in finned lengths from 12" to 120".

*Send for details in Publication 305*

**Nesbitt**
**HEATING AND COOLING SURFACE**
**Made and Sold by John J. Nesbitt, Inc., Philadelphia 36, Pa.**
**Representatives in principal cities—see telephone directory**

# *Keep Gimbels Comfortable*

Dominating Milwaukee's Southgate Shopping Center, Gimbels five-million-dollar Suburban Department Store represents the latest developments in retail merchandising and department store design.

On the roof of the building sit twenty-two Gallaher power exhausters, out of view of the passers-by on U.S. Highway 41, the main route between Chicago and Milwaukee. Ranging in size from a 520 CFM unit to one that exhausts 23,000 CFM, these certified test-proven Air-Vans® ventilate the 200,000 square feet of floor space in the store.

John Lofte of Lofte & Fredericksen, the Milwaukee firm that planned the ventilating system at Gimbels, chose Gallaher Air-Vans® for several reasons. Low silhouette and heavy construction were what he was looking for. Gallaher had both. "Through prior use of the Gallaher exhausters, we have learned that we can rely on their performance," Lofte says.

In Gimbels new Milwaukee Suburban Store, twenty-two Gallaher Air-Vans® exhaust a total of 119,000 cubic feet of air per minute.

Gallaher units also have low noise levels and patented built-in scroll effect design, and they are available in special metals. The motor is out of the air stream, and the entire unit is shipped ready to install directly to the duct system. Lofte, like many other engineers, knew that Gallaher can be applied to almost any industrial or commercial ventilation problem.

Direct Drive units 150-11,000 CFM. Belt Drive 3500-65,000 CFM, developing static pressure to 4".

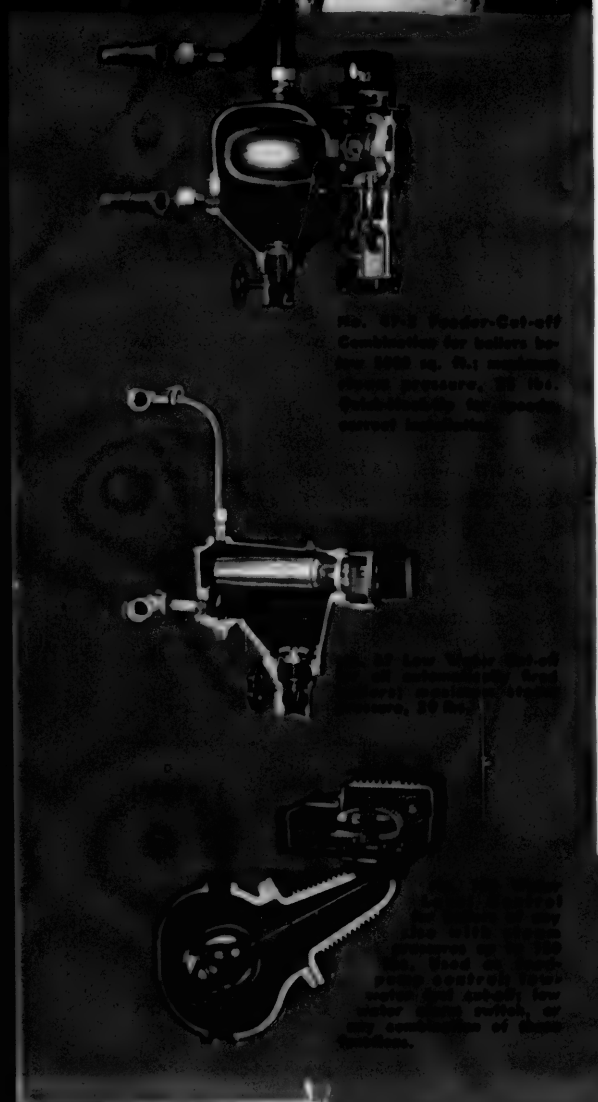
*For further information write*

Patents 2188741 2526290
Patents pending

**The GALLAHER Company**

4108 DODGE ST. OMAHA, NEBRASKA

**Pioneers in Research-Designed Power Roof Exhausters**



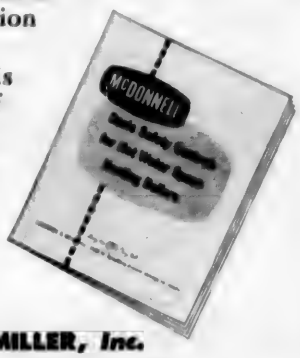
# Don't let the gauge glass fool you...

That's a steam boiler all right in the picture above. The gauge glass gives it away.

But to call attention to the perils of low water, Sam could be looking at a hot water boiler just as well.

Both steam boilers and hot water boilers are in the same boat when it comes to low water and the troubles and expense it can cause. True, the need was recognized with steam boilers first. But today many insurance companies, local codes and federal specifications insist on the same kind of protection for hot water heating boilers.

The best answer in either case is a McDonnell Feeder Cut-off Combination. To learn all the facts about low water in hot water boilers write for copy of new folder on "Basic Safety Controls for Hot Water Space Heating Boilers".



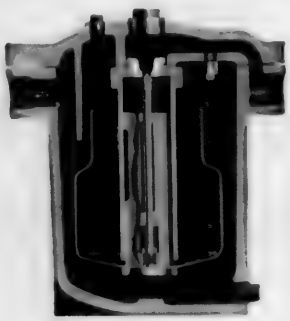

**McDONNELL & MILLER, Inc.**
3500 N. Spaulding Ave., Chicago 18, Ill.

*Doing One Thing Well*

**McDONNELL**
*Water Line Controls*

# snap action

**ELIMINATES STEAM WASTE**



# illinois

## STEAM TRAPS

## *SIMPLE — EFFICIENT — DEPENDABLE*

The valve action of an Illinois trap is instantaneous. It is either wide open or tight shut. Wire drawing is impossible. The valve stem travels independently of the bucket—no other trap has this feature.

Here are some "reasons why" of Illinois' outstanding popularity:

**SIMPLE**—moving parts are valve and bucket only, all motion vertical...**CANNOT AIR-BIND**—continuous air venting through thermostatic air vent—no steam loss...**CANNOT BLOW STEAM**—valve always water sealed...**NO LEAKAGE AT REDUCED PRESSURE—NO LEAKAGE AT REDUCED RATE OF FLOW**—at any point in the range...**NO CHATTERING DURING FLOOD CONDITION**...**SURFACE DISCHARGE**—flushes out all grease and sludge...**VALVE AND SEAT**—hardened steel alloy...**INSPECTION EASY**—without disturbing piping...**DRAINS CONDENSATE EQUALLY WELL**—from compressed air lines, air separators, air after-coolers, gas mains.

*Sizes from ½ inch to 2 inches and pressures from 5 psi up to 250 psi.*
*Extra heavy duty steel bodies for pressures up to 600 psi.*

ILLINOIS ENGINEERING COMPANY

illinois ENGINEERING

2045 SOUTH RACINE AVENUE • CHICAGO 8, ILLINOIS

DIVISION OF AMERICAN AIR FILTER COMPANY, INC.

# man may reach the moon

**before you replace the boiler you buy today**

## . . . for LOW COST STEAM TOMORROW

## buy a SUPERIOR STEAM GENERATOR TODAY

Superior Steam Generators encompass the most complete line of packaged boilers available. Write for complete details today.
Fire Tube types to 600 b.h.p. (Write for Catalog 719 F).
Water Tube types to 45,000 lbs./hr. (Write for Catalog 719 W).

Man will reach the moon . . . tomorrow perhaps . . . but more than likely "tomorrow" in the dictionary of scientists means 20 years . . . and that's a long time to pay the penalty of high steam costs. A boiler is a long term investment; and the equipment you buy today determines your steam costs for years to come.

Superior Steam Generators are designed and built to last longer, and to operate at higher efficiencies throughout their entire serviceable life. Evidence of this you can see for yourself in Superior's bigger, heavier construction and completely integrated design. Superior Steam Generators provide more steam per dollar over a longer serviceable life.

*for performance you can* **BANK** *on*

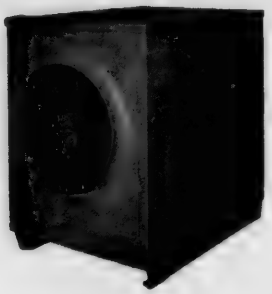
**SUPERIOR COMBUSTION INDUSTRIES INC.**
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
STEAM GENERATORS

Halstead & Mitchell

# for LONG LIFE PROTECTION

## COOLING TOWERS



with the exclusive

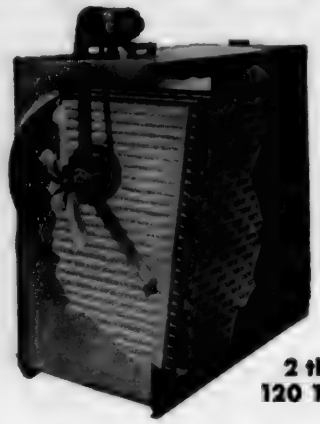
## 20-Year Guarantee!

on the wetted deck surface against rotting or fungus attack

***YOU ARE GUARDED WHEN YOU CHOOSE A HALSTEAD & MITCHELL RESIDENTIAL OR COMMERCIAL TOWER***

Only Halstead & Mitchell can offer a 20-Year Guarantee on the wetted deck surface against rotting or fungus attack because only Halstead & Mitchell creosotes cooling tower wood. No other material, subject to deteriorating or rusting, can be so guaranteed.

Stainless steel fans, sheet steel cabinets hydraulically painted with vinsynite, vinyl zinc and chlorinated rubber . . . add to this protection for the longest life. There's no extra cost for these extra protections . . . just extra long time benefits on the job.



**2 thru 120 TONS**

## CONDENSERS

with economical

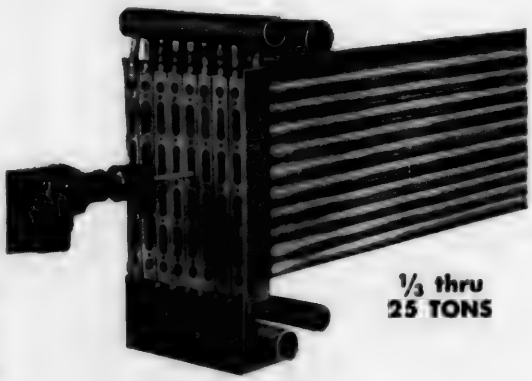
## Lifetime Cleanability

for always-new efficiency

The cooling tower you select works with a condenser, and here again you are guarded by Halstead & Mitchell.

CLEANABILITY in a water-cooled condenser costs no more, but troubles from poor water conditions vanish. Heat transfer efficiency is maintained at new unit levels for life, for a simple mechanical cleaning tool restores heat transfer surfaces in minutes.

Regardless of whose condensing unit you buy, do what almost all leading manufacturers have done — specify CLEANABILITY. It's your most important protection . . . why settle for less?



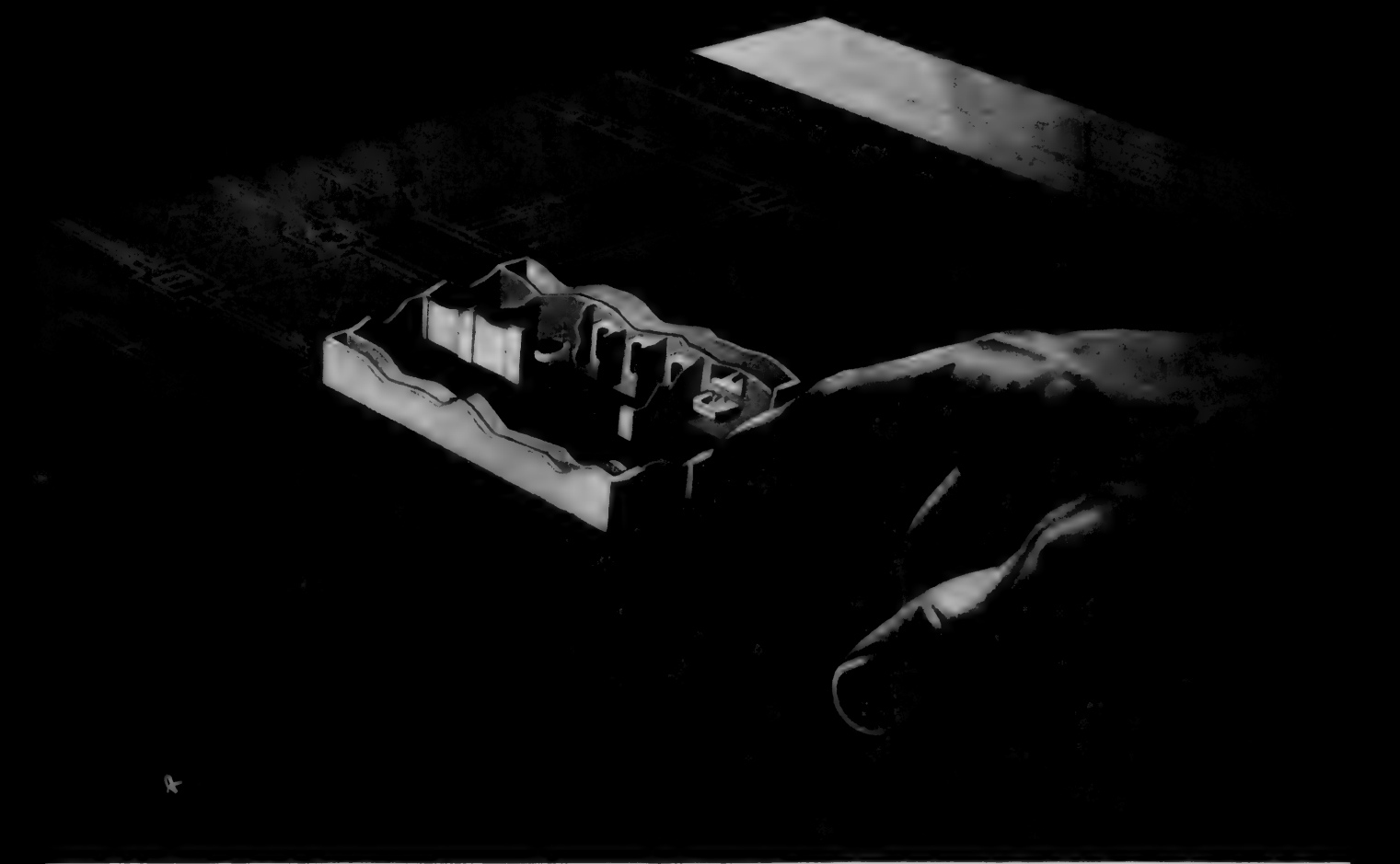
**⅓ thru 25 TONS**

**AT LEADING HEATING AND REFRIGERATION WHOLESALERS EVERYWHERE**

*Write for Detailed Specifications*

HM Halstead & Mitchell

**BESSEMER BUILDING • PITTSBURGH 22, PA.**



# but what about the rooms that everybody sees?

Board rooms and presidential suites get a lot of attention in the plans . . . but the thoughtful architect knows that they do little in forming tenant and public opinion of his buildings. Only a handful of people ever see them.

The places that EVERYBODY sees are the rest rooms. They are usually the *only* areas where the architect can dictate final appearance down to the last detail. Attention devoted to making the rest rooms completely modern, sparkling clean, and attractive in appearance pays off in employee morale. . . in tenant approval . . . and in continuing prestige for the designer.

"Off-the-floor" fixtures are one major means of creating modern, clean, attractive rest rooms . . . and they are used in most of the nation's newest major buildings. It is significant that all such plumbing fixtures are supported by ZURN SYSTEM• wall-type fittings and carriers. The special, engineered features of the ZURN SYSTEM assure that all stresses will be carried by the fittings and none by the wall—make it simple and easy to install, align, and replace plumbing fixtures . . . and permit changes in floor or wall treatment to be made at any time. There are no regrets when ZURN SYSTEMS are selected, as over 800,000 successful installations already serving can testify.

"Off-the-floor" fixtures carried on ZURN SYSTEMS help to attain the latest and finest in wash room and rest room appearance . . . permit hospital-like standards of cleanliness and sanitation to be easily maintained . . . and play a tremendously important part in making and keeping the building "young." For more complete details on the increasingly important part modern rest room design is playing in modern building fields, ask for our new booklet "Behind Closed Doors." 110-2

**J.A. ZURN MFG. CO.**

PLUMBING DIVISION

ERIE, PA., U.S.A.

The Zurn Zero Zone• is created by mounting off-the-floor plumbing fixtures on ZURN SYSTEM behind-the-wall fittings and carriers. This permits the highest degree of rest room sanitation to be attained and maintained. All major plumbing manufacturers make fixtures to fit this system.

*See our catalog in Sweet's Architectural File and Industrial Construction File.*

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# eliminates air conditioning problems when relocating partitions...

# multi-vent®

## LOW VELOCITY AIR DIFFUSERS

For architects and engineers designing air conditioned modular office space, Multi-Vent solves a troublesome problem. Multi-Vent air diffusing panels, once installed flush in the ceiling, need not be moved, altered in any way, or even adjusted when partitions are moved to suit tenants' changing needs.

Since Multi-Vent introduces conditioned air through the perforations in standard acoustical ceiling pans at low velocity, and since the air is gently diffused downward into the room, there is no "throw" or "blow" to bounce off nearby partitions. It is for this reason that a partition may actually bisect a Multi-Vent panel without affecting comfort conditions in the surrounding area.

**Write for detailed literature and name of representative in your area.**

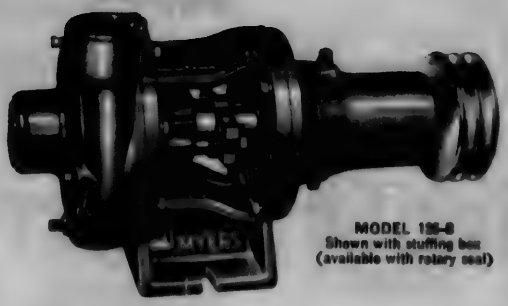
**multi-vent division of THE PYLE-NATIONAL COMPANY**

WHERE QUALITY IS TRADITIONAL

1374 North Kostner Avenue, Chicago 51, Illinois

SALES AND ENGINEERING REPRESENTATIVES IN PRINCIPAL CITIES OF UNITED STATES AND CANADA

MODEL 125-M
Shown with stuffing box
(available with rotary seal)




MODEL 125-S
Shown with stuffing box
(available with rotary seal)

# NOW...a complete line

## of centrifugal pumps for air conditioning from...

# MYERS

MODEL 100-S
Rotary seal only

MODEL 100-M
Rotary seal only

***FULL RANGE OF SIZES***
⅓, ½, ¾, 1, 2, and 3 horsepower, motor-mounted or belt-driven models.

***TWO CASING SIZES***
1″ x 1¼″ or 1¼ x 1½″.

***ALL-BRONZE IMPELLER***
Accurately balanced for smooth operation.

***REMOVABLE BRONZE WEARING RINGS***
Easily replaced for longer pump life.

***ROTARY SEAL***
Eliminates leakage (stuffing box may be specified on "125" models.)

***CORROSION-RESISTANT SHAFT***
Stainless steel for trouble-free service.

***WIDE RANGE OF CAPACITIES AND HEADS***
Capacities to 90 GPM. Heads up to 135 feet.

***Write today*** *for Bulletin 210 on* Myers *Centri-Thrift Pumps.*

# Myers

**PUMPS** WATER SYSTEMS AND WATER SOFTENERS

The F. E. Myers & Bro. Co., Dept. HV-8, Ashland, Ohio

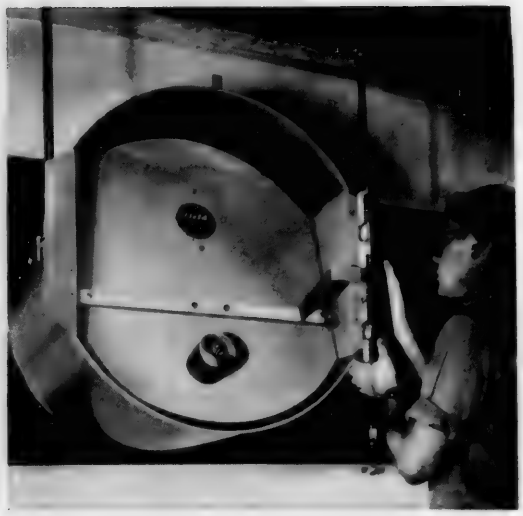
**DEPENDABLE,**

**PRECISELY ACCURATE**

# Draft Control

***for coal fired, oil fired, gas fired or gas-oil fired***

## HEATING PLANTS



### FIELD TYPE "M" for coal and oil fired heating plants

Heavy duty commercial model in 28" and 32" sizes. Heavy, rigid construction assures long, trouble free service. Stainless steel knife edge bearing for permanent sensitivity. Also available in 6" through 24" sizes for domestic and commercial installations. First choice of heating men — the round control you can level on any flue.

### FIELD TYPE "MG" for gas and gas-oil fired heating plants

A heavy duty, precision built control in sizes 8" through 32" for commercial and industrial installations. Stainless steel knife edge bearings for permanent sensitivity. Gate opens inward to regulate updrafts, and outward to relieve down-drafts. Optional safety switch available where codes require. Fully proven, accepted virtually everywhere.

## *They're real* HEAVYWEIGHTS

Compare the weight of a Field Control to any other available. Here is proof of the massive, welded construction, long, vibration-free service, that permits Field's supreme accuracy.

| Size Control | Gate | Thickness of Parts Side Plates | Ring | Collar | Wt. without Crtn. or Crate |
|---|---|---|---|---|---|
| 14 M | 16 Ga. | 16 Ga. | ⅜ x 2" | 22 Ga. Galv. | 19# |
| 16 M&MG | 16 Ga. | 16 Ga. | ⅜ x 2" | 18 Ga. Galv. | 28# |
| 18 M | 16 Ga. | 16 Ga. | ⅜ x 2" | 18 Ga. Galv. | 35# |
| 20 M&MG | 16 Ga. | 16 Ga. | ⅜ x 2" | 18 Ga. Galv. | 41# |
| 24 M&MG | 14 Ga. | 16 Ga. | ⅜ x 2" | 18 Ga. Galv. | 65# |
| 28 M&MG | 14 Ga. | 14 Ga. | ½ x 4" | 14 Ga. H.R.S. | 110# |
| 32 M&MG | 14 Ga. | 14 Ga. | ½ x 4" | 14 Ga. H.R.S. | 140# |

**field**

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of H. D. CONKEY & COMPANY, Mendota, Ill.

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Propeller type ventilating fans deliver large volumes of air at low resistance and low current consumption. All wheels are machine balanced for smooth, vibrationless operation. Made in 2 types and 10 basic sizes to cover a wide range of industrial applications. Pressed steel panels provide rigid support and simplify installation. Totally enclosed motors mounted in heavy welded wire safety guard. Wheel diameters from 10 inch to 48 inch. Direct or belted drive. Capacities from 610 cfm to 24,200 cfm. Penthouses for roof installation of **nyb** Propeller Fans can be furnished in 6 sizes. Louvers open and close automatically to protect fan against the weather. Separate louvers for wall mounting also available.

*Write for Bulletins*

All New York Blower Company products are laboratory tested, accurately rated and fully guaranteed in strict accordance with Standard Test Codes.

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FACTORY, LAPORTE, INDIANA

# How to kill three duct problems

# with one insulation . . .

Thermal, acoustical and vapor barrier problems are "dead ducks" when you use ULTRALITE*, the long glass fiber insulation. Here's why: Due to its unique long glass fiber composition, ULTRALITE is the toughest, most resilient glass fiber insulation on the market, with a record of ten years of successful application. Because of this extra strength, it can be adhered to sheet metal and run through the brakes and shears at the same time the ducts are formed — without worry that it will tear, compress, or delaminate.

Ducts formed in this way are *completely insulated units,* ready to install on the job. They solve the noise problem without impairing the efficiency of the unit because ULTRALITE Duct Liner has a low air friction coefficient. The same insulation that soaks up objectionable sound also insulates the ducts against heat gain or loss. *No vapor barrier is necessary;* with the insulation on the *inside* of the duct, the duct itself becomes the vapor barrier.

Try this time-saving new method on your next job, and you'll be delighted with both cost and performance. But be sure to use ULTRALITE — the only flexible glass fiber insulation with a 10-year record of successful performance.

*Reg. U. S. Pat. Off.

**NOTE**

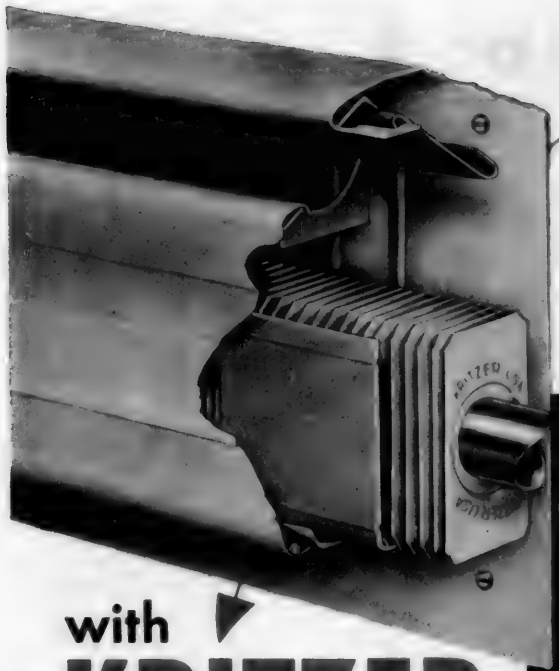
Should you continue to wrap ULTRALITE around the exterior of ducts for thermal protection, be sure to line the plenum and short supply and return ducts with ULTRALITE Duct Liner. Do so even on jobs where duct liner is not specified, and you will be well repaid, for this will make all the difference between an enthusiastic and a dissatisfied customer.

**ULTRALITE is stocked locally in 57 cities. Your nearby distributor is listed in the Yellow Pages under "Gustin-Bacon Insulations."**

**GUSTIN-BACON** *Manufacturing Company* GUSTIN gb BACON

Thermal and acoustical glass fiber insulations • Pipe coverings and fittings • Railroad gaskets and supplies

222 W. 10th Street, Kansas City, Missouri



# CLEAN HEAT

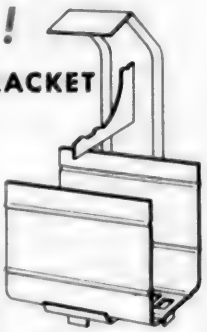
with

# KRITZER "K" LINE RADIANT BASEBOARD

## makes super-salesmen out of your satisfied customers!

*Exclusive Kritzer FEATURE!*

**COIL SUPPORT BRACKET AND CRADLE**



Designed and developed by Kritzer engineers. Coil cradle fits snugly to fins of the coil to prevent movement in the cradle and damage during operation. Cradle moves with the coil, running smoothly on the ribbed bracket assuring quiet during expansion and contraction of coils in use.

The support bracket is so designed that the face plate of the baseboard snaps firmly to it making a simple, solid assembly.

A survey shows that the cleanliness of radiant baseboard heating leads the list of praises for Kritzer Baseboard: "No dust streaks on the walls", "It doesn't stir up or redistribute the dust in the house", "For the first time we have used light colors for decorating". Next is the clean, crisp lines of the baseboard design which blend with any style of interior. It is easy to keep clean, too.

You will find that the "K" Line is easy to install which means more installations, more satisfied customers, and more profits to you. The "K" Line is made of heavy gauge steel. It will withstand the wear and knocks of an active home giving a lifetime of carefree heating comfort.

The "K" Line is a high quality, low-cost radiant baseboard made for residential and institutional use. For more information write to Kritzer Radiant Coils, Inc., 2901 Lawrence Avenue, Chicago 25.

SEE YOUR JOBBER FOR KRITZER PRODUCTS

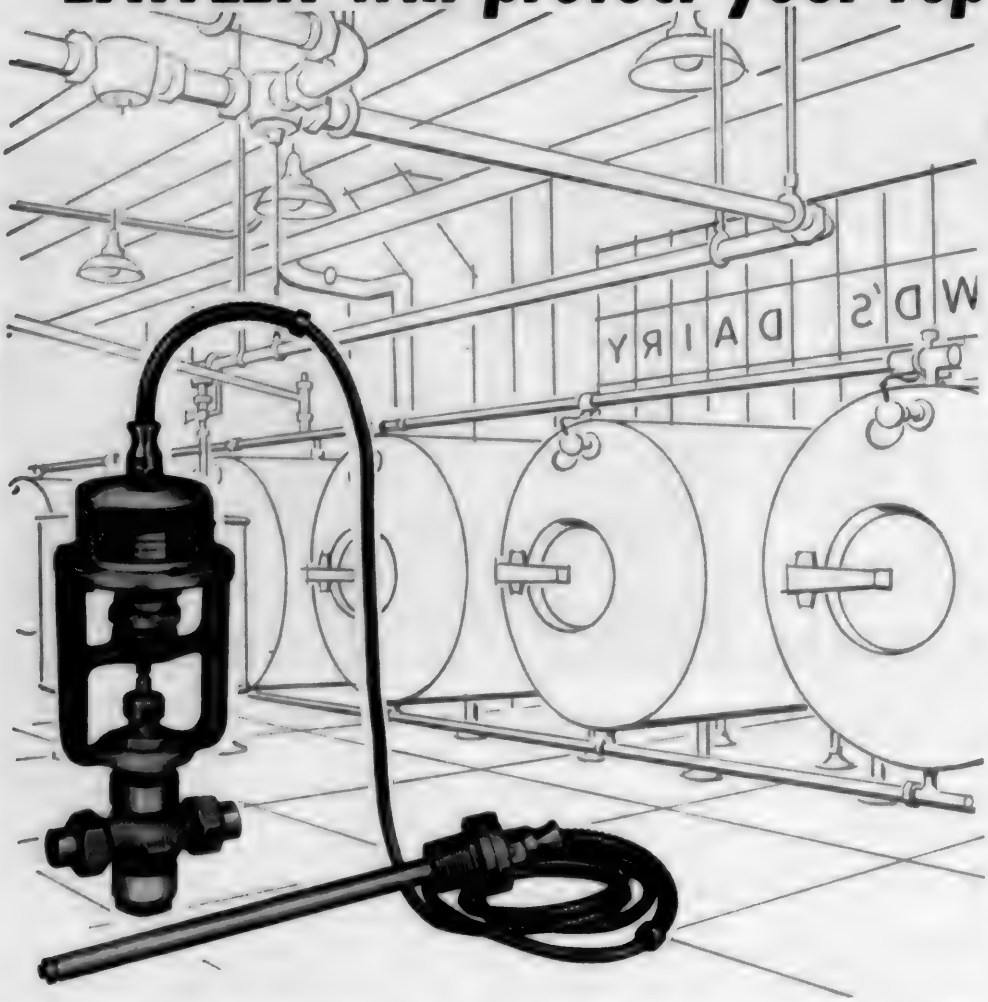
KRITZER BASEBOARD HEATING • KRITZER FIN-PIPE COILS
KRITZER RADIANT PANEL HEATING

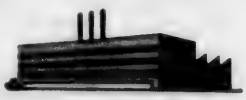
**KRITZER**

*IF IT'S KRITZER, IT'S RIGHT, SIR!*

# NOW, and TEN YEARS from now—

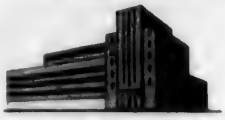
## *LAWLER will protect your reputation!*



IN FACTORIES

POWER PLANTS

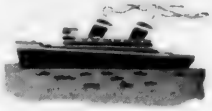


COMMERCIAL BUILDINGS

PROCESSING PLANTS

DAIRIES

INSTITUTIONS



SHIPS

. . . Wherever Steam is Used

**Type "S" Thermostatic Temperature Regulator** for automatically regulating the flow of liquid or steam through a valve . . . in a dairy, for example, which is illustrated above.

Lawler's "Performance-Tested" design combines pioneering experience with engineering leadership. The use of specially chosen metals assure YOUR customers years of positive, accurate temperature control with lowest maintenance cost . . . the best insurance YOUR REPUTATION can have.

**"Performance Tested" for Longer Life**

STEAM TEMPERATURE REGULATORS

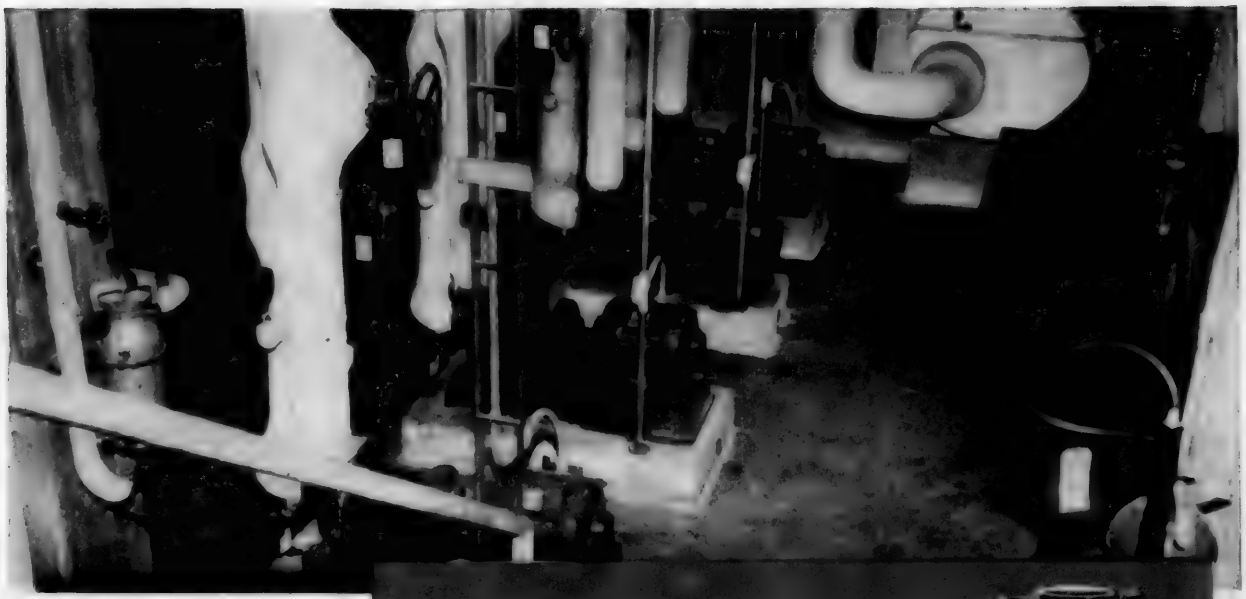
SHOWER MIXING VALVES

WATER CONTROLLERS

TEMPERING VALVES

*The Lawler Line* **of Thermostatic Controls**

**LAWLER AUTOMATIC CONTROLS, INC.** 453 North MacQuesten Parkway, Mount Vernon, N. Y.



*B & G Universal Pumps in combination heating and cooling system.*

# for noiseless operation

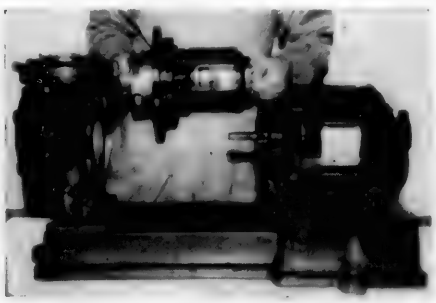
**B&G**
**UNIVERSAL PUMP**
designed specifically to operate *QUIETLY* in hot water heating systems

To perform satisfactorily in forced hot water heating systems, a centrifugal pump must have more than mere ability to meet head and capacity requirements. Unless *quiet operation* is a built-in feature, the pump may be a potential source of trouble.

B & G Universal Pumps are designed and built to meet this prime requirement of forced hot water heating systems. Noise has been engineered out...*you have to touch a B & G Universal to tell if it's running!*

This pump is available in a complete capacity range for apartments, institutions, commercial and industrial buildings. For smaller installations, the B & G Booster offers the same qualifications of noiseless, dependable operation.

Complete data is given in the B & G Catalog—send for your copy.



**EASIER TO SERVICE**

**The B & G Universal Pump can be serviced without breaking pipe connections. Removal of a few bolts permits separation of bearing bracket and motor from the pump head—making all parts accessible. Precision manufacturing methods assure positive accuracy of fit and complete interchange of parts between pumps of the same size.**

**BELL & GOSSETT**
**COMPANY**
**Dept. DZ-4, Morton Grove, Illinois**
*Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, West Toronto*

BARBER COLMAN

# uni-flo Engineered Air Distribution

## How high velocity air valves solve space and cost problems

Several problems faced engineers planning a year-round, high velocity air conditioning system in this Morrison, Illinois, building after it was purchased by General Electric Company. The air conditioning system with all ten zone reheat coils had to be installed in a small equipment room. Ducts had to be located over existing suspended ceilings, without interfering with piping already in place. Efficient distribution at low noise level was the final objective—at a price within budget requirements. A trip to the Barber-Colman Laboratory convinced system designers that Uni-Flo Air Valves can be used at branch duct take-offs to deliver low velocity air to branches from high velocity trunk ducts. With all diffusers on each branch served by one air valve, and using a minimum of sound attenuation material, costs were reduced to meet budget figures.

*Project Engineers*—BOOTH BROTHERS AND COMPANY

**Two-story office building** in Morrison, Illinois, acquired by General Electric Company. Space and cost problems arising from year-round air conditioning of an existing building were solved with a modern high velocity air distribution system, using Uni-Flo Air Valves.

**Fewer Air Valves Are Required, Reducing Costs,** because one Uni-Flo High Velocity Air Valve can be installed at a low velocity branch duct take-off from a high velocity trunk duct to serve several diffusers. This is a pioneer advantage of the Uni-Flo design.

**Venturi-Flo Ceiling Diffusers** harmonize with modern office decor, contribute efficient distribution of the conditioned air, free from drafts and disturbing noise. Each diffuser is individually adjustable for simplified balancing of the system. Pleasing results testify to sound engineering of the system.

**A Uni-Flo High Velocity Control Unit** is combined with a Venturi-Flo Ceiling Diffuser and made available as a "package" ready to attach in locations where it is desirable or necessary to continue high velocity to an individual diffuser.

### BLAZING THE TRAIL TO BETTER AIR DISTRIBUTION

***First with comprehensive, reliable, high velocity data***

When Barber-Colman introduced the Uni-Flo Air Valve, results of laboratory tests on high velocity performance were released to the air conditioning industry. That reliable data enabled system designers to proceed with a greater number of satisfactory applications. Comprehensive performance data and design information for engineers are available in bulletin F-6598. You may obtain your copy by calling our nearby Field Office, or by writing us.

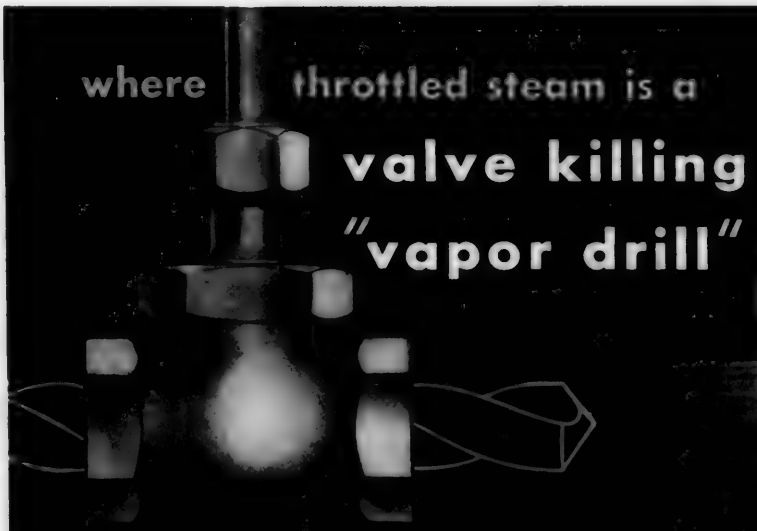
**Barber-Colman Company**

**Dept. T, 1102 Rock Street, ROCKFORD, ILLINOIS, U. S. A.**

***Field Offices in principal cities***

Air Distribution Products • Automatic Controls • Small Motors
Industrial Instruments • Aircraft Controls • Overdoors and Operators
Molded Products • Metal Cutting Tools • Textile Machinery

# where throttled steam is a valve killing "vapor drill"



**JENKINS PLUG TYPE VALVES**
with the
**500 BRINELL**
STAINLESS STEEL
ARMOR SEAT
will
lower costs

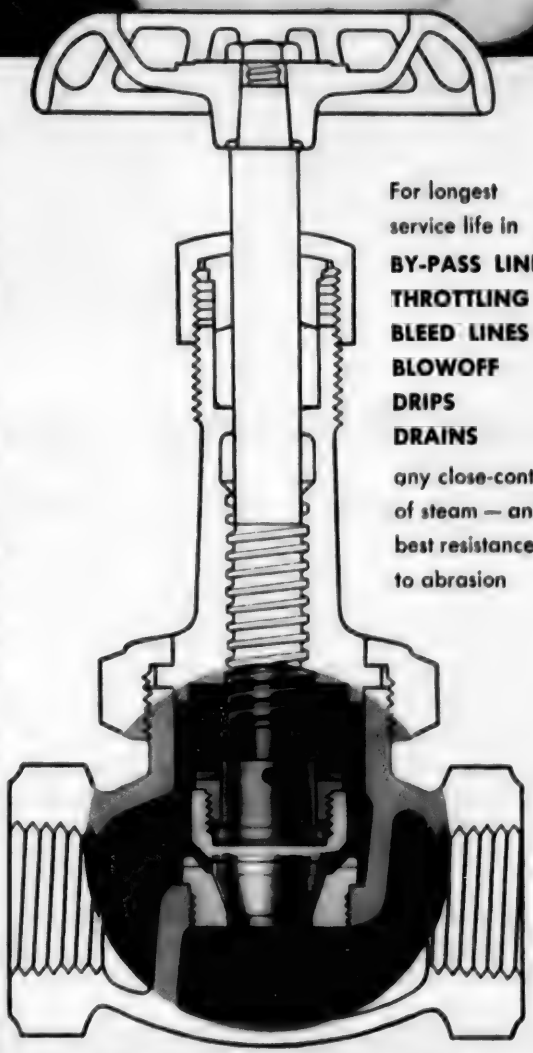
Closely regulated steam erodes grooves in seating units and drastically cuts service life of ordinary valves.

Jenkins Plug Type Valves have been engineered in every detail for maximum wear in such valve-killing service. The stainless steel Armor Seat defies the "vapor drill", and Jenkins quality throughout gives them top rating for wear-proof and trouble-proof perfomance.

Make you own test . . . in your toughest steam service . . . or anywhere that abrasion or erosion causes frequent valve failure. Compare, part for part, with any similar valve. You'll find that, again, Jenkins *extra value* pays off in longer life and lower maintenance cost.

Plug and seat ring are Jenkins JX500, a Stainless chromium alloy steel made to Jenkins high strength specifications, heat-treated to 500 Brinell. Seating surfaces are super-hard and mirror-smooth, offer highest resistance to galling, cutting, abrasion, and erosion. Wide, steep, 30° total taper permits extremely close regulation of flow and vapor-tight closure.

The Stainless steel plug is securely fastened to the spindle with a bronze locknut. Spindle is aluminum bronze with a tensile strength exceeding 70,000 lbs., — has high corrosion resistance.



For longest service life in
**BY-PASS LINES**
**THROTTLING**
**BLEED LINES**
**BLOWOFF**
**DRIPS**
**DRAINS**
any close-control of steam — and for best resistance to abrasion

**300 lb. 200 lb. 150 lb.**
**GLOBE and ANGLE**

For complete information call your Jenkins Distributor — ask for Form 202. Or write: Jenkins Bros., 100 Park Ave., New York 17.

SOLD THROUGH PLUMBING-HEATING AND INDUSTRIAL DISTRIBUTORS

JENKINS VALVES
LOOK FOR THE JENKINS DIAMOND
SINCE 1864
JENKINS
Jenkins Bros.

**In new TEMTRON* 2-ton air conditioner . . .**

# Only Microlite® solves thermal insulation and noise reduction problems

"Here's why all the insulation in the Temtron is Microlite," says James F. Brownell, Chief Engineer of the Ultrasonic Corporation's Air Conditioning Division.

"First of all, Microlite gives us the *high thermal efficiency* we need.

"Secondly, it is an *effective sound absorber*. The 1-inch thick Microlite used in the evaporator and blower sections of the Temtron help to prevent transmission of compressor and blower noises."

To build "two tons of refrigeration with the lowest operating cost in the field," the Temtron engineers took advantage of the basic economies resulting from use of Microlite.

Chief Microlite economy is the fact that it can be handled with speed and sureness. This results from its flexibility and high tensile strength. Microlite is inherently stronger because its glass fibers are longer. These longer fibers are made possible by L·O·F Glass Fibers' exclusive "Electronic-Extrusion" process.

Other Microlite advantages are its light weight; its low space requirement; the fact that it does not support fungus growth or bacteria; that its inorganic glass fibers are non-combustible; that it resists settling, is fire-resistant and moisture-resistant; its resilience, which permits compression packaging—saves shipping and storage space.

*Trademark

L·O·F GLASS FIBERS

FREE: Send for literature giving full information about Microlite. Write L·O·F Glass Fibers Company, Dept. 63-85, 1810 Madison Avenue, Toledo 1, Ohio.

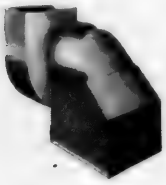
**L·O·F GLASS FIBERS COMPANY**
**TOLEDO 1, OHIO**

Makers of glass fibers by the exclusive "Electronic-Extrusion" process

The MASSACHUSETTS Line

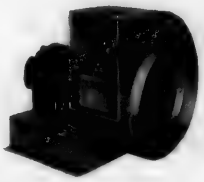
# TOPS in performance

FULL MEMBER N.A.F.M.



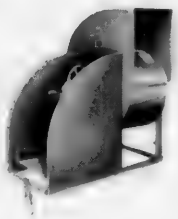
Series MSV—Design 2 Belt Driven—Ten Sizes, 7½" to 27" Wheel Diameter.

Type "S" Direct Driven—Eight Sizes, 6¼" to 13½" Wheel Diameter.

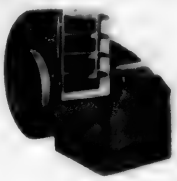


## UTILITY TYPE VENTILATING SETS

Series MSV Design 3 Belt Driven 30" Wheel Diameter

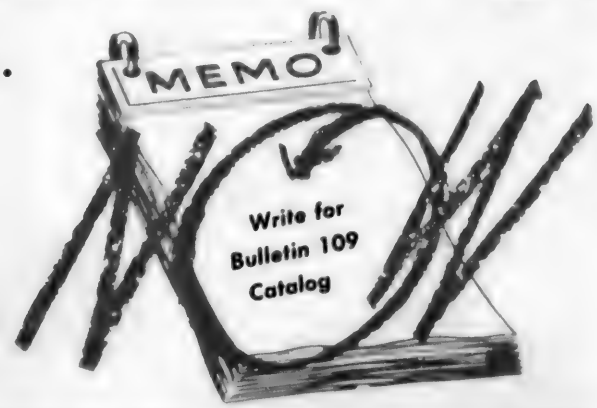


The MASSACHUSSETTS Line of Utility Type Ventilating Sets offers a wide selection of sizes, belt or direct driven, adaptable to standard size extremely heavy gauge aluminum shutters, with or without motor and drive covers, any rotation or discharge, simplified installation, suitable exterior finishes for extreme conditions, sturdy construction, complete ratings and dimension charts.



### OTHER MASSACHUSETTS LINE PRODUCTS . .

- Power Roof Ventilators
- Heavy Duty Blowers (Forward Curve or Backward Curve Blades)
- Furnace Fans
- Unit Heaters
- Propeller Fans
- Universal Blowers
- Air Conditioning Units




The BISHOP & BABCOCK Mfg. Co.

# American-Standard announces

# the new Horizontal Remotaire

**...provides economical heating-cooling**

**...makes best use of available space**

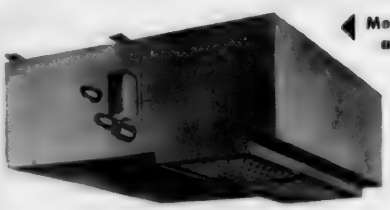
• You can hang Horizontal Remotaire Units on the ceiling—between rooms, in closets, above false ceilings. Similar to the famous Remotaire floor models, these compact horizontal units heat, cool, filter and recirculate *all* the room air. Three models solve every installation problem. Four sizes—200, 300, 400 and 600 cfm capacities—meet every room need.

Horizontal Remotaires are only 8½" to 10¾" high . . . require minimum headroom for reduced installation costs. These units are equipped with extended winding motors for low current consumption and have sealed-in oil supply for dependable operation and absolute minimum maintenance.

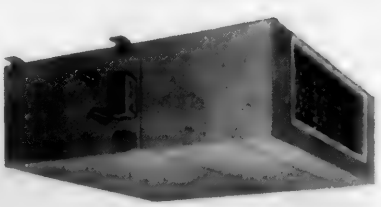
Like all Remotaire units, this new model operates with heated or chilled water supplied from a central plant through a simple, compact piping system. The new Horizontal Remotaire unit can readily be used in new construction and is especially suitable for remodeling. It allows you to install the unit in almost any available space, and often permits the use of your original piping system.

For more information on this new addition to the complete line of American-Standard Remotaire Heating-Cooling Systems, just write to Plumbing and Heating Division, American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pa.

Model H—ideal for use in a hallway.



◀ Model HB—especially suitable for closet installation.



▲ Model HR—best to use free-hanging from a ceiling . . . can be concealed.

AMERICAN-Standard

WATER HEATING-COOLING SYSTEMS

*never before*

*a pneumatic thermostat like this!*

# The Honeywell Pneumatic Round

*so technically advanced in every way that it outmodes all others!*

## *The first completely new pneumatic thermostat since the trend to contemporary design in modern architecture!*

*New force-balance principle, new low-mass sensing element, new design make it the fastest responding, most accurate, best looking pneumatic thermostat on the market!*

ACTUAL SIZE

### *so beautiful!*

**Modern Round Styling Complements Contemporary Interiors**

A refreshing departure from previous pneumatic thermostat design gives the Pneumatic Round pleasing style features to enhance the simplicity of the modern commercial building. Designed in the studios of Henry Dreyfuss, world-famous industrial designer, this graceful thermostat was made for today's functional interior. And its bronze-colored metal cover may be lifted off and painted to blend in with the color of the walls or furnishings.

## *so easy to use!*

### Direct-action Dial Simplifies Operation

Setting, reading and checking of performance are simplified by one easy-to-read scale that serves both the thermometer and the thermostat setting indicators.

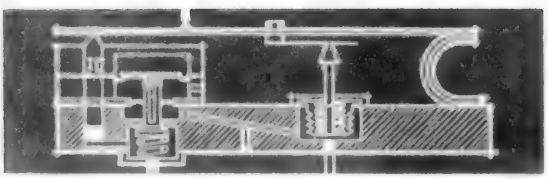
Adjustable stops inside the thermostat let your client limit the temperature range. Or, he can lock the desired temperature setting in place. This feature is most attractive to hospitals and schools where limited authority in dictating temperature conditions may be advantageous.

## *so very practical in design!*

### Rugged Construction Assures More-Than-Adequate Protection

A durable metal cover locks to the Pneumatic Round to guard it against shock or tampering. Other working parts are protected in the base. A grille, completely encircling the thermostat, protects inner parts yet allows free flow of air so that room temperature is accurately measured.

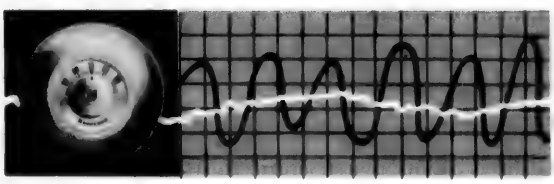
# THE HONEYWELL Pneumatic Round



## *so ingenious in concept!*

### Force-balance Principle Gives Precise Modulation

By making new use of the force-balance principle—used in the finest, most accurate industrial instruments—the Pneumatic Round provides an automatic self-check on each change in control signal. Through a special signal feedback arrangement, it creates a snubber action which stabilizes the operation of the valves and dampers and makes possible the use of a low-mass, fast-acting sensing element. This results in smooth, accurate system response.



## *so marvelously sensitive!*

### Low-mass Sensing Element Makes for Fastest Response

The Honeywell Pneumatic Round is the fastest responding pneumatic thermostat on the market. The unique force-balance principle allows the use of a low-mass bimetal element. This makes the Round so sensitive that it responds almost instantly to changes in room temperature. This sharply reduces the lag in the air conditioning system response by providing for more exact modulation of the system as changes in demand occur.

## *so mechanically superior in every detail!*

### Numerous Engineering Improvements Facilitate Easy Installation and Maintenance

**1** Two new flexible plastic tubes plug into main and branch air lines for simple connection. Internal springs prevent them from crimping or collapsing.

**2** Calibration is accomplished quickly by turning a screw with an ordinary screwdriver.

**3** A readily accessible throttling nut aids adjustment of the throttling range.

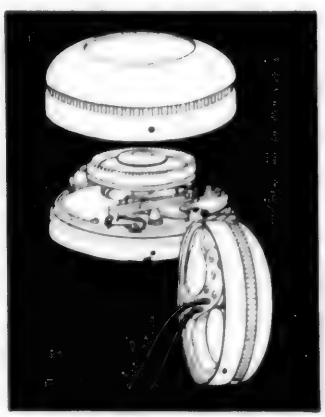
**4** Branch line air pressure is easily tested by inserting a plug-in type air gauge directly into the gauge adapter.

**5** Loosening two screws instantly permits removal of the cover.

**6** Tight filter keeps air clean—is easily replaced if necessary.

**7** Thermostat is simply constructed with fewer number of parts.

**8** Fittings for either flush or surface mounting are provided with each thermostat. For modernization work a special adapter plate neatly covers hole left in wall by old thermostat.



*in every room . . . in every type of commercial building . . .*
*wherever your plans call for the latest and*
*finest in temperature control equipment . . .*

## THE HONEYWELL

# Pneumatic Round

*has application features that surpass*
*all previous pneumatic thermostats!*

**IN HOSPITALS . . .**

nurses need not use room lighting or flashlights to check temperature settings — Luminous "Nite-Glowing" Dials are clearly visible in total darkness. Cover available in satin chrome finish if desired.

**IN SCHOOLS . . .**

the simple dial setting and easy reading of the Pneumatic Round aid teachers in matching classroom temperatures with student activity. This makes for more take-home learning.

**IN APARTMENTS . . .**

painted to harmonize with the decor of the room, the Pneumatic Round brings residential luxury to every tenant. Easy adjustment and accurate performance provide healthful, comfortable temperatures.

**IN INDUSTRIES . . .**

the outstanding performance of the Pneumatic Round assures constant temperatures throughout the plant. And people working in the proper temperature can't help but produce more efficiently.

**IN OFFICES . . .**

the precise temperatures maintained by the Pneumatic Round promote increased office efficiency. With comfortable offices in the morning and an automatically controlled climate all day long, occupants think and work most productively.

**IN HOTELS AND MOTELS**

guests are sure to enjoy their stay because a thermostat controls the temperature in every room. Yet, there'll be no danger of tampering because the cover locks on. And adjustable setting screws allow your client to limit the temperature range.

**AND THERE'S NO INCREASE IN PRICE FROM ORDINARY PNEUMATIC THERMOSTATS!**

*For further information,*
*call your local Honeywell office.*
*Or write to Minneapolis-*
*Honeywell Regulator Company,*
*Minneapolis 8, Minnesota*

MINNEAPOLIS **Honeywell** H HONEYWELL

*First in Controls*

MINNEAPOLIS 8, MINNESOTA • TORONTO 17, ONTARIO
*112 offices across the nation*

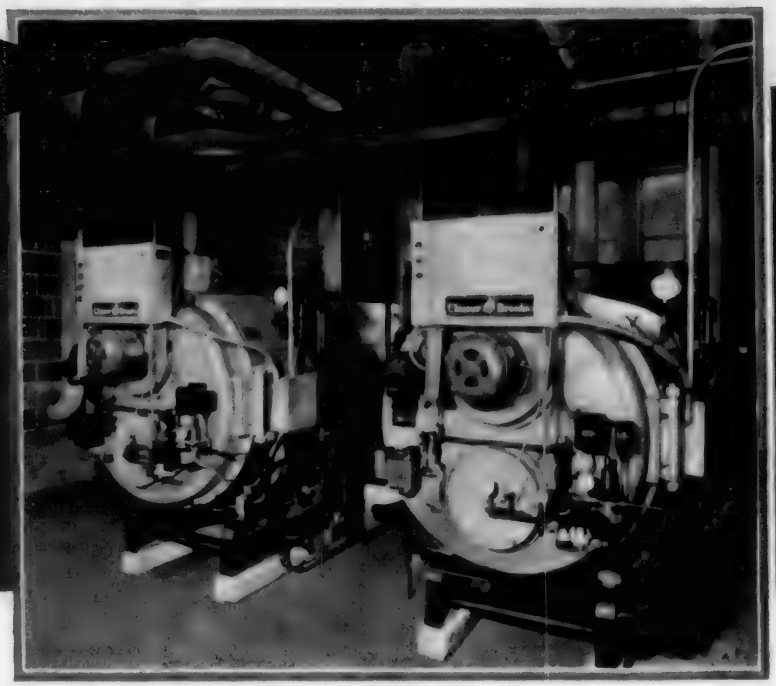
1931

## *Cleaver-Brooks pioneers big steam capacity in small space*

This veteran 20-hp heating boiler — built by Cleaver-Brooks and installed in 1931 — is still in daily use. It is proof of the dependable service you can expect from Cleaver-Brooks' famed four-pass, self-contained boiler construction for any heating or processing need.

1955

# Cleaver-Brooks is first again with the "CB"



- All main burner components are completely integrated for automatic operation.
- More boiler capacity in less space through elimination of extended burner assembly platform.
- Guaranteed 80% efficiency — Four pass construction. 5 sq. ft. of heating surface per bhp.
- 11 sizes — 79 models — 15 to 150 hp, (steam or hot water) for oil, gas or combination oil/gas use. Other models available through 600 hp.
- Complete (Boiler-Burner) unit approval by Underwriters Laboratories — conforms to ASME codes. Factory tested before shipment.

**The "CB" is the most easily maintained package boiler on the market. Removal of only nine bolts (on the largest sizes) opens hinged doors for fast inspection, cleaning or service. This convenience has earned widespread praise of insurance firms.**

BOILER users will quickly appreciate the surprisingly silent operation of the new forced-draft "CB" — *with the fan mounted inside the front hinged door.* Design avoids use of thin sheet metal housings and usual "chattering" and vibration.

Even greater combustion efficiency is yours with the new "CB" air-atomizing burner, with integral air compressor. All burner components are confined to the front head and the control panel is at operator eye level.

For complete facts on the boiler that's ahead in design, performance and economy, write: Cleaver-Brooks Company, Dept. J, 315 E. Keefe Ave., Milwaukee 12, Wis., U.S.A. Cable Address: CLEBRO — Milwaukee — All Codes.

*Write for copy of latest "CB" Boiler Bulletin covering your size requirements — contains specification data to help you plan.*

Cleaver Brooks

*Originators of the self-contained boiler*

# The latest in convector styling—designed for every application

Now public, commercial and institutional buildings—old or new—can be equipped with beautifully styled, efficient, quality-built Modine Convectors. There's a model to meet every requirement—30 types, 8000 sizes.

And each model . . . regardless of its price bracket . . . is craftsman-built in every detail . . . the reason why Modine has been a leader in convector design and fabrication for more than a quarter of a century.

Before you specify or buy convectors, be sure you have the Modine story. See the Modine representative listed in your classified phone book or write for Catalog 255—Modine Mfg. Co., 1511 DeKoven Ave., Racine, Wis.

30 types 8000 sizes
There's a Modine Convector to meet your exact needs: Deluxe, standard and institutional models — free-standing, fully and partially recessed, concealed and wall-hung types with many design variations.
Modine
CONVECTOR RADIATION
R-1273

*Special Qualities*

**for all sheet metal work . . .**

# WEIRTON

## GALVANIZED STEEL

Whether it's complicated work for a special purpose or an everyday duct job, there's a Weirton galvanized steel to help you do it quicker—and better. Weirton's close control of quality through every step of the production process is carefully planned—and faithfully executed—to assure a tight coat that forms readily, looks better, and resists both peeling and flaking.

So when the job calls for galvanized steel, call Weirton and be sure. Let their experience serve you and your customers—to your profit.

**WEIRTON STEEL COMPANY**
Weirton, West Virginia
a division of
NATIONAL STEEL CORPORATION

# How to Select an Economical Temperature Regulator

First of all, what does economy mean where temperature regulators are concerned? In some industries it means improvement of product or reduction of spoilage through closer control of process temperatures. In others, it means the paring down of operating expense. The price of the regulator itself is a relatively small factor.

Today's buyers are shopping for:

1. Accuracy of control — not only when the regulator is new, but throughout its service life
2. Dependability — to prevent loss of production time
3. Minimum installation and maintenance cost

Here are a few tips on what to look for when you're installing a new or replacing an old temperature regulator —

**Packless construction** . . . and for this reason: A diaphragm operated, packless regulator minimizes friction. There are no closely fitted parts to stick or bind because of uneven expansion or collection of foreign matter. Also, there's less maintenance, since no repacking is ever required.

**A guarantee against wire drawing** of the seats and discs. Insist on it. This guarantee in combination with single seat design assures you of tight shutoff; you avoid expensive steam losses as well as loss of product in a process application.

**Broad control range.** In a standard regulator you should expect a control range of 100 F. And make sure the unit you select has a vapor tension thermostat that can take over-temperatures of at least 100 F.

**Easy maintenance.** Why ask for grief? Your temperature regulator should be basically simple in design so that it can be serviced by average plant personnel. All parts should be readily accessible for testing and cleaning.

**Double duty.** There's no point in buying a separate pressure regulator when you can select a temperature regulator that combines both temperature and pressure control within the same unit.

**Self-operating.** Make sure you get a regulator that operates on its own initial pressure. By doing so, you avoid the purchasing and maintenance of an air compressor plus air piping, and you're sure of uninterrupted operation during electric power failures.

• • • •

All of these points are important to you when it comes to selecting an economical temperature regulator. Perhaps you didn't realize you *could* expect so much. And perhaps you didn't realize that Spence Temperature Regulators offer all these features and more. May we send you our Bulletin T 500 containing further details? SE 130

SPENCE ENGINEERING COMPANY, INC.
*Walden, New York*

# Marley Double-Flow Aquatowers

DOUBLE-FLOW AQUATOWERS have a proud heritage: they are the only cooling towers in the intermediate capacity field backed by years of selective development. Behind them stand Marley engineering and design ability and the Marley Double-Flow patents, without which no cross-flow tower can deliver full performance from every cubic foot of structure.

These towers are thoroughbreds in every characteristic. Every element is designed, manufactured and guaranteed by Marley. Included are the sturdy structure, high-performance filling and drift eliminators, and all mechanical equipment—fans and drive units. All parts are service-proved in thousands of units now in completely satisfactory operation the country over.

DOUBLE-FLOW AQUATOWERS are supplied with either asbestos cement board or steel casings for job erection. Steel cased PACKAGED DOUBLE-FLOW AQUATOWERS (60, 80 or 100 tons capacity) are shipped in three sub-assemblies that reduce construction time from days to hours.

*Trademark Reg.

MARLEY

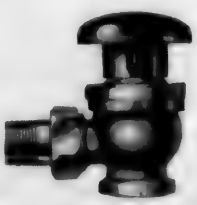
**The Marley Company**

Kansas City, Missouri

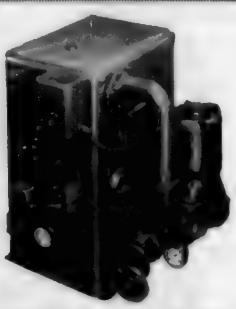
# New beauty for along-the-wall

*New Thermo Vector painted to simulate wood paneling in office of Mathias Klein, President, Mathias Klein & Sons, Chicago, Ill. Architect: Wright, Martin & Assoc., Wilmette, Ill. Heating Contractor: Fettes, Love & Sieben, Chicago*


**From radiator traps**
**to fully engineered systems**
**you can DEPEND ON DUNHAM for**
**everything you need in heating**

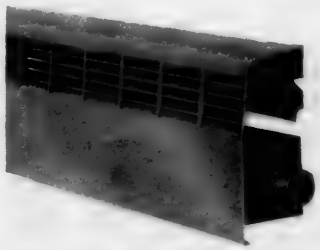


**Dunham Radiator Valves.** Complete line of radiator valves, traps and other specialties for steam heating.

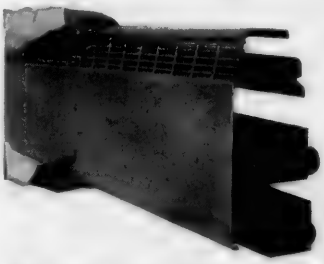


**Dunham Vacuum Heating Pumps.** Single and Duplex models. No close clearance parts. Only one moving element.

# radiation jobs...Dunham Thermo Vector



*Here you see the tailored, trim lines of new Thermo Vector.*



*Here you see how easily new Thermo Vector is installed using "hanging strip."*

*Here you see the lever-operated damper installed in three tier Thermo Vector.*

**—with a tailored, trim look**

New Dunham Thermo Vector looks good ANYWHERE! Its smooth, unbroken horizontal lines blend beautifully in any office or commercial building . . . and Thermo Vector is sturdy enough to stand up for years and still look good in any industrial or institutional installation.

**—with "built-in" versatility**

New Dunham Thermo Vector is used flush mounted along the walls . . . one, two or three tiers high . . . with steam or hot water . . . steel or nonferrous elements. Use with full back or just use "hanging strip." Front outlet grille eliminates wall smudging—lets you install Thermo Vector ANYWHERE.

**—with cost-cutting ease of installation**

To install Dunham Thermo Vector, all you do is position the back or "hanging strip" on wall. Attach element support to it and hang elements. Mount one-piece cabinet . . . then accessories which conceal elements and piping for the "finishing touches." Fronts, backs and lever-operated damper easily cut on the job.

For further information, write for Bulletin ACHV-8, C. A. Dunham Company, 400 W. Madison St., Chicago 6, Ill.

DUNHAM

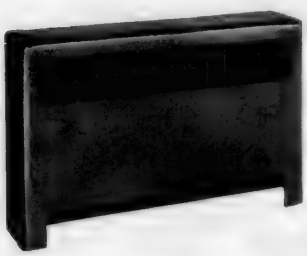
**THERMO VECTOR RADIATION**

TRADE-MARK

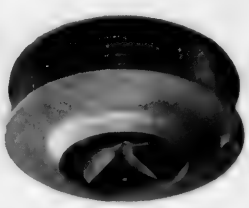
**RADIATION • CONTROLS • UNIT HEATERS • PUMPS • SPECIALTIES**

*Quality First for Over Fifty Years*

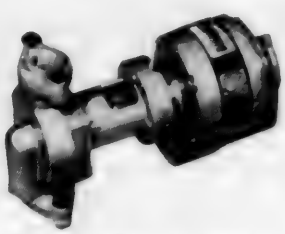
**C. A. DUNHAM COMPANY • CHICAGO • TORONTO • LONDON**



**Dunham Radiation.** Full range of sizes and types of convectors, baseboard and finned tube radiation.



**Dunham Unit Heaters.** Line includes heating-cooling units, vertical, horizontal discharge and large blower unit heaters.



**Dunham Circulators.** Heart of Dunham's complete hot water line. Single-spring motor coupling. Brand-name motor.

**Dunham Vari-Vac®.** Precision temperature control system uses continuous-flow "cool" steam, cuts fuel costs up to 40%.

Here today.....

# AND HERE TOMORROW, TOO!

*the permanent installation is*

## DURIRON ACID RESISTING DRAIN PIPE

Duriron is a high silicon iron alloy with a very high resistance to corrosion, abrasion and erosion. This resistance is present throughout the entire pipe wall.

Installed by ordinary plumbing methods, Duriron can be counted on to outlast the building, in most cases. Obviously, replacement and building repairs are virtually eliminated. Bulletin PF/4 lists complete details and standard fittings. Insist on *Duriron.*

**A PARTIAL LIST OF RECENT DURIRON INSTALLATIONS**

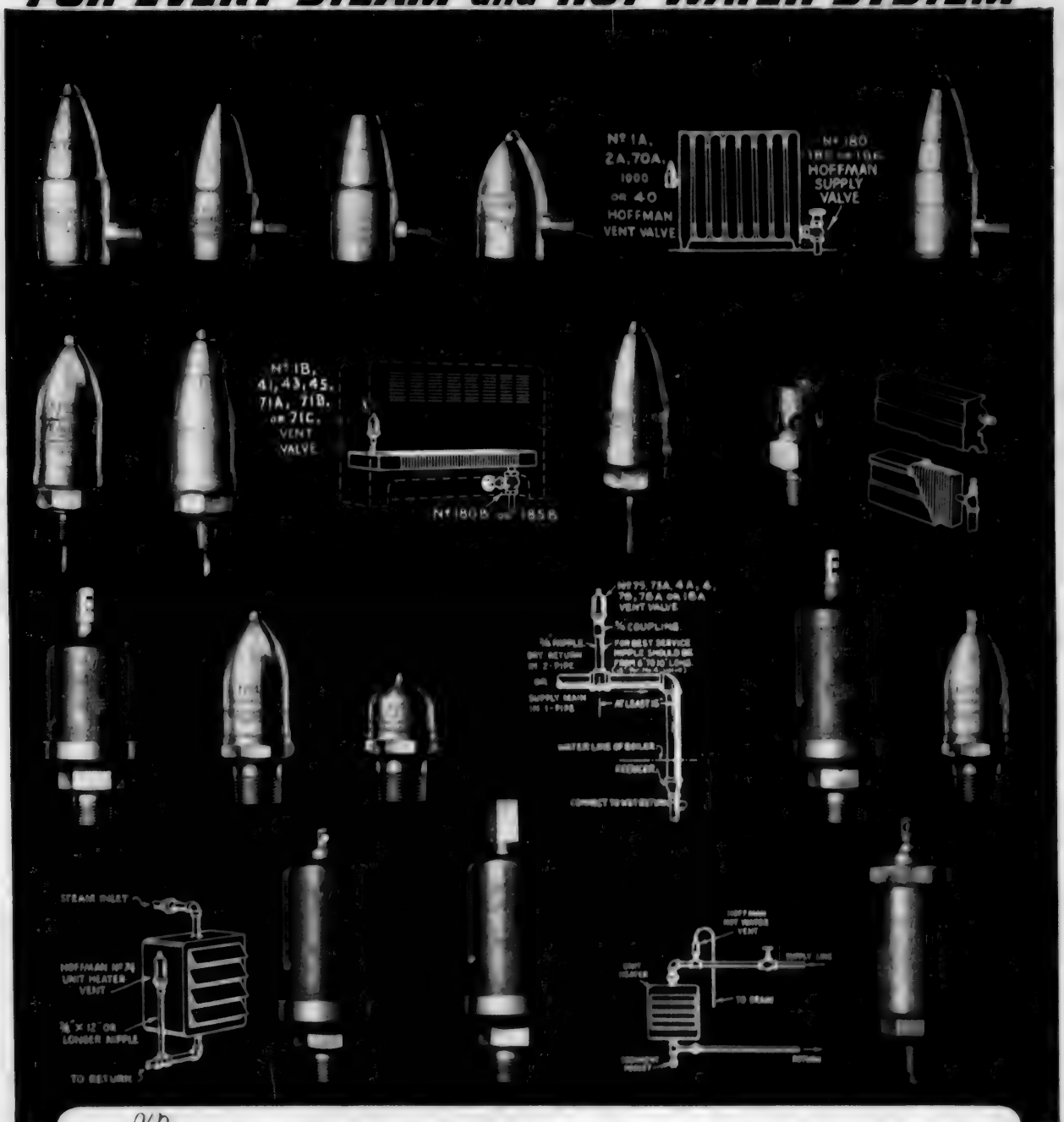
**Roswell Park Memorial Institute, Buffalo, N. Y.**
**University of Texas Medical Center, Galveston, Tex.**
**Dorrance Laboratory, M.I.T., Cambridge, Mass.**
**Tippecanoe Laboratories, Eli Lilly and Company, Lafayette, Ind.**

**THE DURIRON COMPANY, INC.**
**DAYTON, OHIO**

DURIRON
LOOK FOR THE NAME ON EVERY PIECE

# HOFFMAN VENTING VALVES

## FOR EVERY STEAM and HOT WATER SYSTEM


Nº 1A, 2A, 70A, 1000 or 40 HOFFMAN VENT VALVE
Nº 180 HOFFMAN SUPPLY VALVE
Nº 1B, 41, 43, 45, 71A, 71B, or 71C, VENT VALVE
Nº 180B or 185B
Nº 75, 75A, 4A, 4, 70, 76A or 16A VENT VALVE
½ COUPLING
½ NIPPLE
DRY RETURN IN 2-PIPE
OR
SUPPLY MAIN IN 1-PIPE
AT LEAST 18"
WATER LINE OF BOILER
STEAM INLET
HOFFMAN Nº 76 UNIT HEATER VENT
½" x 12" OR LONGER NIPPLE
TO RETURN
HOFFMAN HOT WATER VENT
SUPPLY LINE
UNIT HEATER
TO DRAIN

**Have these valves in your stock for the early replacement jobs**

For either one-pipe or two-pipe steam, hot water, residential or industrial heating—Hoffman assures you the correct Vent Valve for each specific requirement. Radiator Valves all feature the hinged drainage tongue. For the hard-to-balance radiators, the Hoffman line includes adjustable-port valves, available for vacuum and non-vacuum systems. It is not too early to order adequate stocks of main and radiator vent valves for modernizing jobs. Call your wholesaler.

**HOFFMAN SPECIALTY MFG. CORP. • 1700 West 10th Street, Indianapolis 7, Indiana**

Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensation Pumps — Sold by Leading Wholesalers of Heating and Plumbing Equipment

# JENN-AIR—COMPLEMENT TO AN ARCHITECTURAL TRIUMPH—NORTHLAND SHOPPING CENTER

*Architect: Victor D. Gruen, Associated Architects and Engineers, Inc., General Contractor: Bryant and Detwiler Co.; Consulting Engineer: H. E. Beyster and Associates, Inc.; Mechanical Contractor Donald Miller Company*

*J. L. Hudson Company streamlined store serves as the focal point of Northland Center*

**Low Contour Exhausters meet functional and aesthetic demands... provide fresh air for comfort—blend with building design concept.**

A blending of aesthetics and functional performance plus accent on customer comfort . . . that is a quick description of Northland Center, suburban Detroit.

Take ventilation. There was need for efficient movement of air . . . carrying off heat from ranges—presses—dryers—the fresh'ning of toilet areas. That was the functional aspect. But ventilators had to blend with the architectural concept, holding an uninterrupted sweep to roof lines. On all counts Jenn-Air Exhausters met the test:

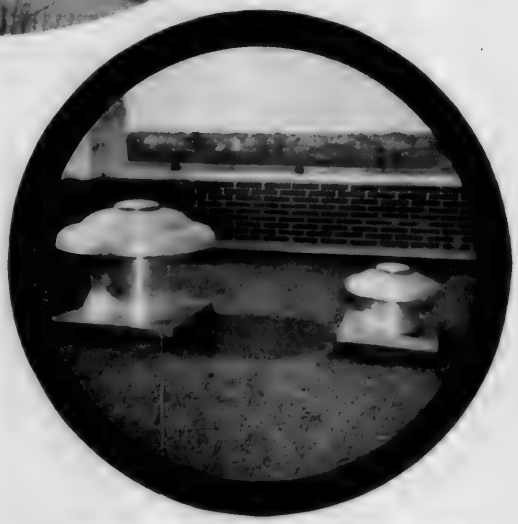
True low contour design that hugs the roof, complementing the modern architectural motif;

Efficient noiseless operation with full ball bearing grease packed motor guaranteed for 10 years uninterrupted service;

Easy installation—bolted directly to the roof—no louvres or unsightly penthouse necessary;

Made of ageless aluminum—built to outlast any structure.

On your next building project consult Jenn-Air Ventilating Specialists in the pre-planning stage.



*Here is a typical installation of two Low Contour Jenn-Air Exhausters on the roof of J. L. Hudson Co. Store in Northland Center. The Large Unit Model 161-CR is connected to five canopies over steam presses. The small Exhauster, Model 90-CR, carries away heat from dryers.*

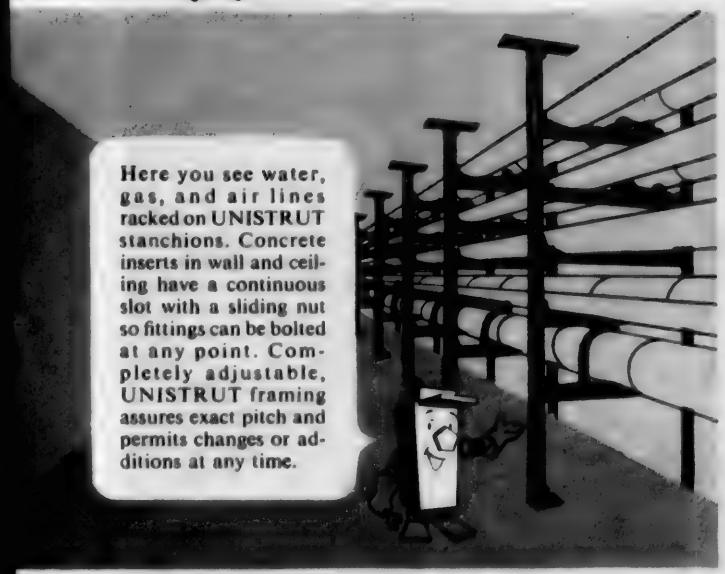
**JENN-AIR PRODUCTS COMPANY, INC.**

Architects & Builders Building • Indianapolis 4, Indiana

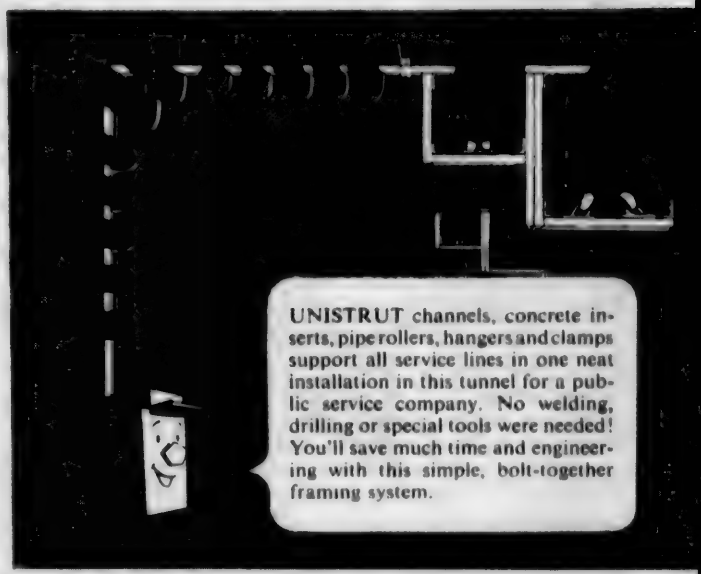
The Sky's The Limit

—when you build with UNISTRUT

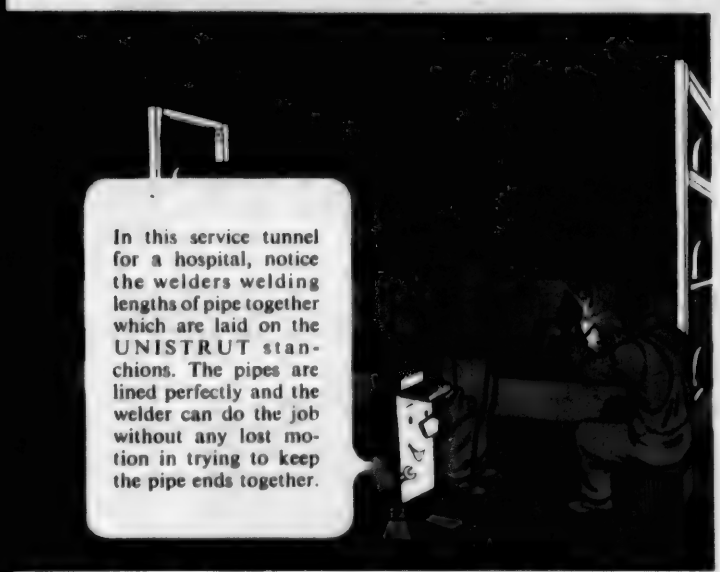
# Mr. Strut cuts pipe racking costs four ways with UNISTRUT framing



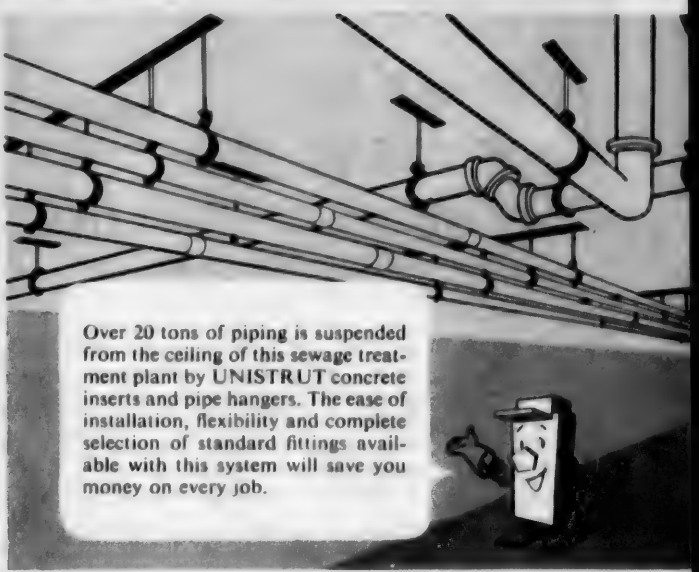
Here you see water, gas, and air lines racked on UNISTRUT stanchions. Concrete inserts in wall and ceiling have a continuous slot with a sliding nut so fittings can be bolted at any point. Completely adjustable, UNISTRUT framing assures exact pitch and permits changes or additions at any time.



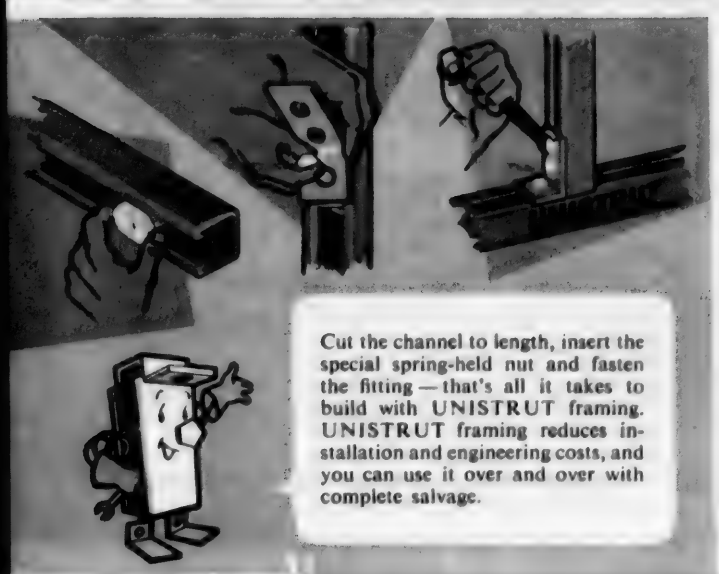
UNISTRUT channels, concrete inserts, pipe rollers, hangers and clamps support all service lines in one neat installation in this tunnel for a public service company. No welding, drilling or special tools were needed! You'll save much time and engineering with this simple, bolt-together framing system.



In this service tunnel for a hospital, notice the welders welding lengths of pipe together which are laid on the UNISTRUT stanchions. The pipes are lined perfectly and the welder can do the job without any lost motion in trying to keep the pipe ends together.



Over 20 tons of piping is suspended from the ceiling of this sewage treatment plant by UNISTRUT concrete inserts and pipe hangers. The ease of installation, flexibility and complete selection of standard fittings available with this system will save you money on every job.



Cut the channel to length, insert the special spring-held nut and fasten the fitting — that's all it takes to build with UNISTRUT framing. UNISTRUT framing reduces installation and engineering costs, and you can use it over and over with complete salvage.

# Free Catalog!

**Send today for your free copy of the 78-page catalog No. 700. Shows countless examples of how to rack, frame, suspend and support all kinds of mechanical and electrical equipment.**

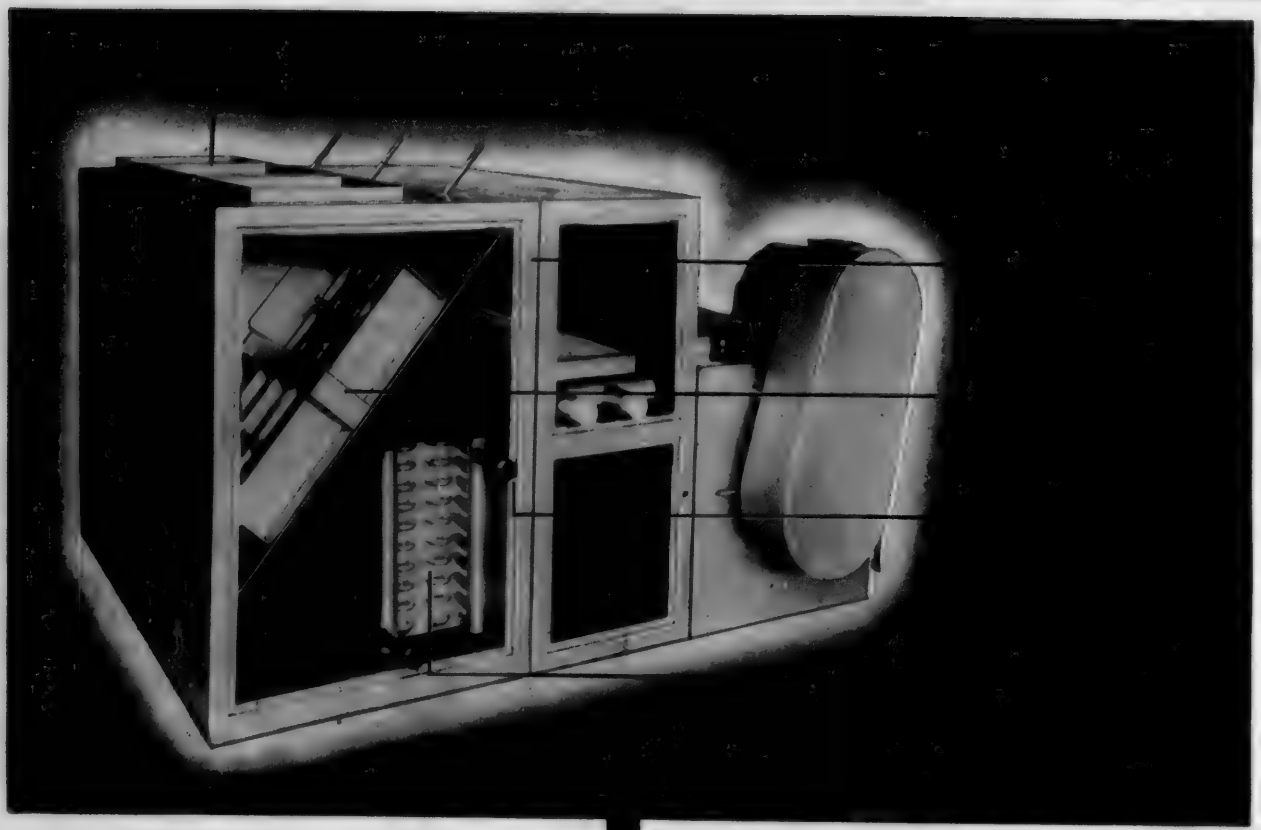
*U. S. Patent Numbers*

2327587 2541908 2329815 2345650
2363382 2696139 2380379 2405631
Other patents pending

**UNISTRUT PRODUCTS COMPANY**
**1013 W. Washington Blvd.**
**Chicago 7, Illinois** Dept. V-8

Please send without obligation items checked below:
☐ Catalog No. 700 ☐ UNISTRUT sample

Name.....
Company.....
Address.....
City.....Zone.....State.....



## ANOTHER NEW PRODUCT IN THE EXPANDING BUSH LINE

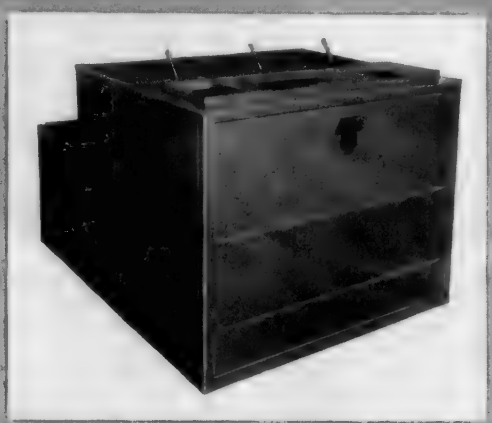
# BUSH MZ MULTIZONE AIR CONDITIONING UNITS

**A single unit replaces several! Bush 'MZ' Multizone Units provide simultaneous air conditioning of separate rooms or zones at any desired temperature . . . make possible *individualized* conditioning of such areas.**

**Steady temperature control possible with Bush 'MZ' Units is especially advantageous where the problem of fluctuating cooling and heating loads exists . . . where sun load and occupancy vary.**

**Contractors, architects and consulting engineers welcome the clean-lined compactness of these units . . . the sectionalized construction which permits easy handling and installation.**

**Capacities range from 2,560 to 24,000 C.F.M.**



BUSH

*Request Bulletin #805 containing complete information.*

**BUSH MANUFACTURING COMPANY · West Hartford · 10 · Conn.**

**RIVERSIDE · CALIFORNIA**

## kno-draft air diffusers

**Architect:** PACE Associates
**General Contractor:** Evans & Taylor
**Mechanical Contractor:** Bollinger & Sames

ONE of the five First Honor Awards in the American Institute of Architects' 7th Annual Competition for Outstanding American Architecture goes this year to the office building of the General Telephone Company of the Southwest, San Angelo, Texas.

Fittingly, the job of distributing air throughout the building has been entrusted to Kno-Draft Adjustable Air Diffusers.

In Kno-Draft you have true functional beauty—clean, simple lines in spun aluminum, handsome in its own right or when painted to blend into the ceiling—combined with a high diffusion efficiency that means ideal comfort.

And with Kno-Draft, the volume and pattern of air flow can be accurately adjusted *after* installation—assuring *uniform temperature without drafts* throughout the area and saving a lot of preliminary slide-rule figuring.

There are round, square and slot-type Kno-Draft Air Diffusers to meet all architectural requirements. For complete specifications, send for the Kno-Draft Data Book. Connor Engineering Corporation, Dept. J-85 Danbury, Connecticut.

CONNOR
kno·draft®
adjustable air diffusers

# Stocked for fast service to you!

**7 Points of uniform goodness in YOUNGSTOWN PIPE**

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

●Your nearby Youngstown Distributor carries a complete stock of good steel pipe, and he'll deliver your order quickly. That's an important help for you. It saves you time delays on jobs and the expense of carrying costly, excess inventory. For all your steel pipe needs, call your Youngstown Distributor.

Youngstown

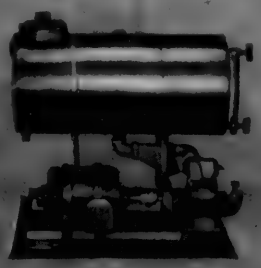
QUALITY · YOUNGSTOWN · SERVICE

**THE YOUNGSTOWN SHEET AND TUBE COMPANY**

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices: Youngstown, Ohio - District Sales Offices in Principal Cities

SHEETS · STRIP · PLATES · STANDARD PIPE · LINE PIPE · OIL COUNTRY TUBULAR GOODS · CONDUIT AND EMT · MECHANICAL TUBING · COLD FINISHED BARS · HOT ROLLED BARS · BAR SHAPES · WIRE · HOT ROLLED RODS · COKE TIN PLATE · ELECTROLYTIC TIN PLATE · RAILROAD TRACK SPIKES



"TM" TURBINE PUMP
Designed for boilers up to 250 hp and discharge pressures up to 150 lbs.

"UV" CONDENSATE PUMP
Capacities ranging from 2,000 to 40,000 sq. ft. EDR, and discharge pressures from 10 to 75 lbs.

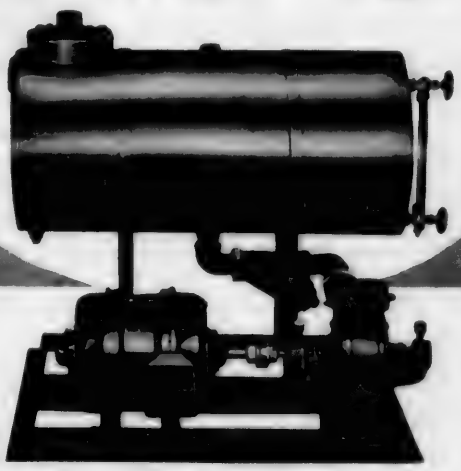
"CV" VERTICAL PUMP
Heavy duty duplex unit with two float switches. Capacities ranging from 500 to 10,000 sq. ft. EDR and discharge pressures from 10 to 20 lbs.

# Skidmore Pumps

## Designed to your specifications

## —will out-perform standard types!

"HS" CONDENSATE PUMP
Capacities ranging from 1,000 to 45,000 sq. ft. EDR and discharge pressures from 10 to 75 lbs.



TYPE "TM"
SKIDMORE TURBINE PUMP

This unit is used for automatically supplying water to the boiler, when boiler water is lost through use of steam in processing plants. Designed for high pressure service—unit is completely assembled and mounted on either steel or cast iron base—pre-tested and ready for immediate shipment.

*SEND FOR BULLETIN NO. 17*

*Write for bulletins or contact the nearest Skidmore representative for complete engineering data.*

***Skidmore has been Synonymous with Quality and Engineering Leadership, Since 1921.***

SKIDMORE PUMPS

**SKIDMORE CORPORATION • ST. JOSEPH, MICHIGAN**

# Fiberglas sets world's "elbow-bending" record!

THIS COMPLETE ELBOW COVERING FABRICATED IN ONLY 29 SECONDS!
Simple pie cuts with an ordinary knife produce perfectly fitting segments. No hacking . . . no sawing!

**Yes,** for speedy handling and fabrication on the job—not only elbows but straightaway runs and odd-shaped equipment, fittings and ducts—Fiberglas* Insulations recognize no equal! Such performance is possible because Fiberglas is light, rigid, non-crumbling, so easy to cut. What a time-and-labor saver! Moreover, it's moisture-resistant and dimensionally stable . . . combines sound absorption with thermal efficiency. Want to test its workability for yourself? Just write, Owens-Corning Fiberglas Corporation, Dept. 41-H, Toledo 1, Ohio.

**Fiberglas PF Panels** for equipment and ducts possess the same workability as the Pipe Covering illustrated at top of page.

**For High Temperatures—KAYLO®**, King of High Temperature Insulations. A faultless performer up to 1200° F. Distributed by Owens-Corning Fiberglas Corporation.

*Technical data will be found in Sweet's File, Chemical Engineering Catalog and Refinery Catalog.*

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®Kaylo is mfd. by Kaylo Div., Owens-Illinois Glass Co., Inc.

# TTINGS

# AIN?

## your reputation!

***QUESTION-MARK FITTINGS**

Who is manufacturer?
How about his reputation?
What is his experience?
Does he give service?
Does he offer complete line?
Is stock available nearby?
Do fittings meet U. S. standards?
Are dimensions accurate?
Is circularity true?
Equal to strength of pipe?
Are fittings permanently marked with manufacturer's trademark and material designation?

**YOU RUN THESE RISKS WITH THESE UNKNOWN PRODUCTS:**

Failure in service... work stoppage... waste.
Impaired efficiency due to improper design.
Non-uniformity... wastes manhours.
Poor availability... costly in emergencies.
Short line supply... handicaps selection.
Lack of service or responsibility.
Lack of engineering help on piping problems.
Lack of cost-cutting advancements.

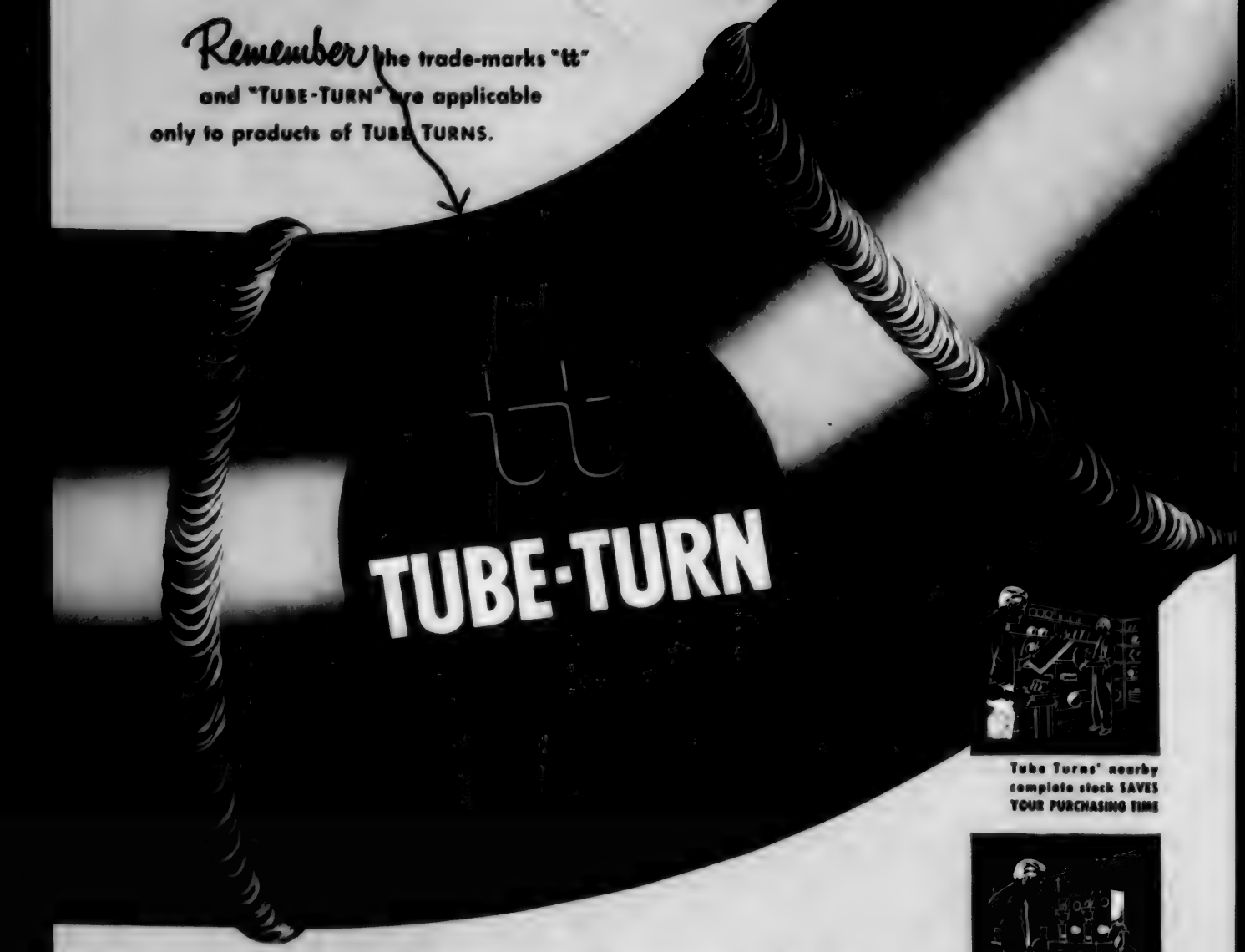
*Presented in the interests of piping safety and economy by*

# TUBE TURNS

A Division of National Cylinder Gas Company
LOUISVILLE 1, KENTUCKY

... Producer of **KNOWN VALUES**

*Remember* the trade-marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS.




# How to safeguard your piping and get *more for your money*

When you buy TUBE-TURN* Welding Fittings and Flanges, you get these known values:

**TOP QUALITY AND SAFETY** **RESPONSIBILITY** **PRECISE UNIFORMITY**
**ENGINEERING SERVICE** **WIDE SELECTION** **LOWEST-COST PERFORMANCE**
**PROMPT DELIVERY** **DESIGN ADVANCEMENTS**

They are made in U.S.A. and are identified by the trade marks shown above.

They meet ALL American Standard and Safety Code requirements.

They are engineered to give maximum strength and performance and in many cases exceed requirements by generous margins.

To get *more for your money* in welding fittings and flanges, specify the leading brand and buy from your trusted Tube Turns' Distributor.



**Tube Turns' nearby complete stock SAVES YOUR PURCHASING TIME**

**Tube Turns' pioneering research GIVES YOU ADVANCED PRODUCTS**

**Tube Turns' engineering help GIVES YOU COST-CUTTING IDEAS**

*The Leading Manufacturer of Welding Fittings and Flanges*

# TUBE TURNS

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A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Detroit • Chicago • Kansas City • Denver
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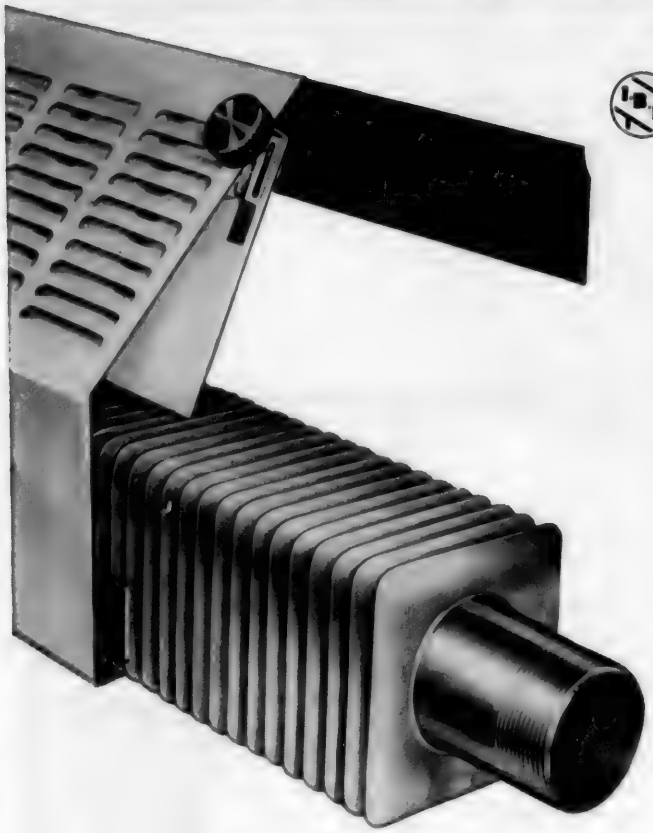
*"TUBE-TURN" and "tt" Reg. U.S. Pat. Off.

SARCOfin

When you buy or specify radiation

# make sure you get all these advantages!



## *Sarcofin offers you:*

**APPROVED RATINGS**—as established by Institute of Boiler and Radiator Manufacturers for finned-tube and baseboard radiation.

**FULL GUARANTEE**—top-quality Sarcofin products, backed up by a *1-year guarantee* against defects in materials and workmanship. Heating elements *guaranteed* for maximum working pressures.

**COOPERATION**—careful selection of radiation by experienced Sarco and Sarcotherm heating engineers.

**UNDIVIDED RESPONSIBILITY**—the protection and convenience assured by obtaining from *one* "Complete Line" source...SARCO-SARCOTHERM... not only Sarcofin finned-tube and baseboard radiation but also heating specialties for steam and hot water, condensation and vacuum pumps, temperature regulators, and weather-compensated control systems for steam and hot water heating.

**SARCO COMPANY, INC.**
**SARCOTHERM CONTROLS, INC.**
Empire State Building, New York 1, N. Y.

MAIL COUPON FOR THESE BULLETINS

**Sarco Company, Inc.—Sarcotherm Controls, Inc.**
Empire State Building, New York 1, N. Y.

Please send me:
☐ 32 page Bulletin No. 1650 on Sarcofin Finned-Tube Radiation.
☐ Bulletin No. 1625 on Sarcofin Baseboard Radiation.
☐ Also information on _____

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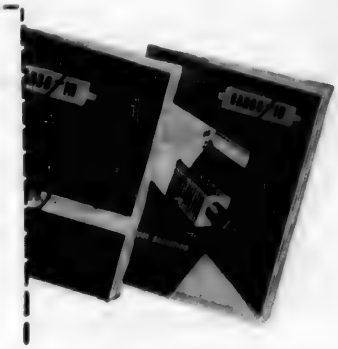
8150-B



# HELP—

**when you need it!**

**You'll like AIRTEMP'S "helping hand" policy of doing business!**

You'll find that Chrysler Airtemp people are helpful. Factory, field representative and distributor, all are ready to lend you a hand.

***Airtemp helps you*** — as a *specialist!* Because Airtemp makes *only* air conditioning equipment, Airtemp gives you undivided attention on sales, application, inventory, credit, service, and other problems.

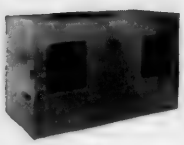
***Airtemp helps you*** — with *advertising* and *merchandising!* National advertising plus promotion assistance on a local basis.

***Airtemp helps you*** — as a *pioneer!* Beginning in "Packaged" air conditioning in 1937, Airtemp has a thorough understanding of dealer problems in this field.

***Airtemp helps you*** — as the *leader!* With more Airtemp packaged units sold than any other make, Airtemp has a name and reputation to uphold. This is your assurance of a continuous conscientious dealer relationship!

***Airtemp helps you*** — with a *complete line!* Ten models! Both water-cooled and waterless! From 2 to 15 H.P.

For complete information on how Airtemp can help YOU, write to: Airtemp Division, Chrysler Corporation, Dayton 1, Ohio.



*Packaged Waterless (Air-Cooled) Air Conditioners— no water needed, no plumbing required. 2, 3, 5 and 7½ H.P.*

*Packaged Water-Cooled Air Conditioners in 6 models, from 2 to 15 H.P.*

*"the line that pays"*

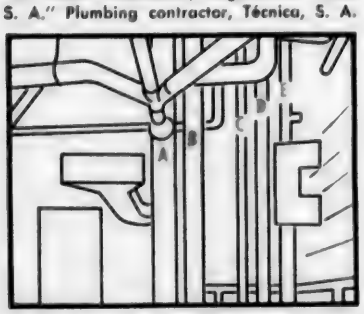
Airtemp

DIVISION OF CHRYSLER

AIR CONDITIONING • HEATING FOR HOMES, BUSINESS AND INDUSTRY

Main pipe shaft. Note compact assembly made possible by the trim, space-saving copper tube and fittings. See pipe sizing diagram below, left.

Mexico's newest and tallest skyscraper. General Director: Adolfo Zeevaert, C. E. Constructed by the Engineering Department of "La Latino Americana, Seguros de Vida, S. A." Plumbing contractor, Técnica, S. A.




A. 8" soil stack. B. 6" vent. C. 3" hot water. D. 4" cold water. E. 3" waste for future use. Laterals to soil stack are 4". All sanitary drainage lines are Type M.

# 43-Story all-copper plumbing . . . in Mexico's tallest building

**COPPER** | **hot and cold water lines**
**sanitary drainage system**
**roof drainage lines**

100,000 pounds of copper tube, Types K, L and M, provide lasting protection in the plumbing system of this new office building of the Latino Americana Insurance Co., Mexico City. Tube sizes ranged from ½" to 12" incl. Anaconda tube was used throughout, with Nacional de Cobre of Mexico furnishing the smaller sizes.

For office buildings or industrial plants, copper plumbing is the most practical and economical. Its light weight makes it easy to handle, reduces structural load. Standard 20' lengths eliminate many joints. Solder-type fittings can be made where threaded fittings are impossible—making it easier to adapt the system to the needs and limitations of the building. Because of savings like these, over-all first cost may be lower than that of a ferrous system. The full savings of a copper plumbing system, however, come from its lasting, trouble-free performance, low maintenance.

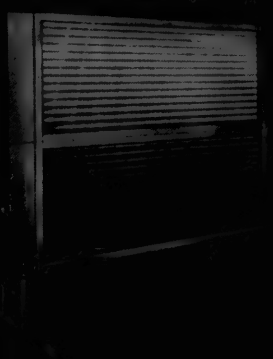
For descriptive literature, write to *The American Brass Company, Waterbury 20, Conn.* In Canada: *Anaconda American Brass Ltd., New Toronto, Ontario.* 5511A

**for copper tubes see your**

**ANACONDA®**

**distributor**

# STOP *using water!*



Eliminate all water problems with UNICON by KRAMER. Any size compressor, regardless of tonnage, can be air-cooled with UNICON.

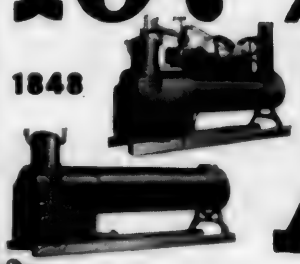
KRAMER **UNICON**

Stands, hoods, and wind deflectors are available for simplified outside mounting
You need nothing else!

WRITE FOR BULLETIN U-210C

KRAMER TRENTON CO. • Trenton 5, N.J.

# 107 YEARS of RELIABILITY ARE BEHIND EVERY AMESTEAM GENERATOR



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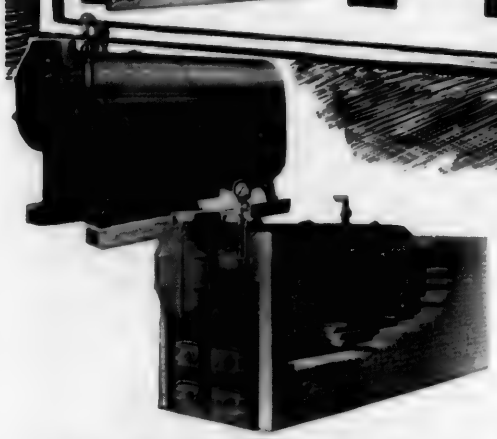

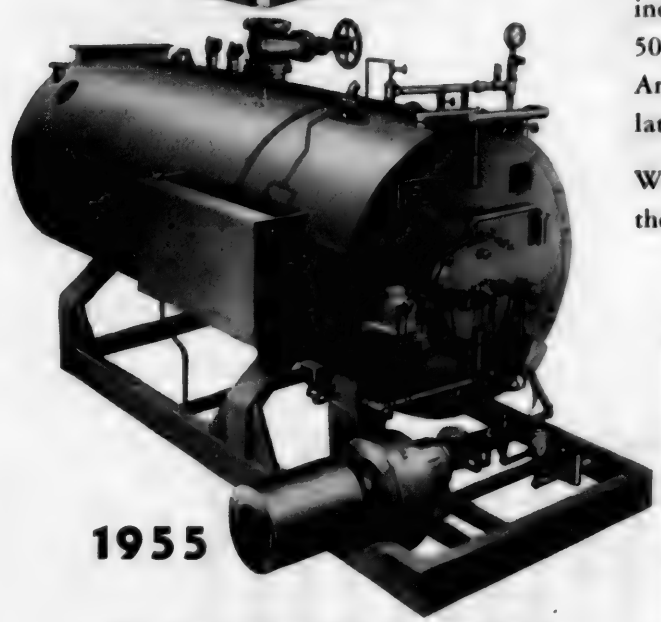

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## AMESTEAM GENERATOR

20 sizes, 10 to 600 H.P., 15 to 200# W.P., oil, gas, or oil-gas combinations with quick fuel switchover feature.

In your selection of a boiler, it's important to remember — experience *does* count. And what better assurance of top boiler quality do you have than the Ames record: 107 years of building fine boilers — boilers which have given economical, satisfactory service throughout the industry! Many Ames units purchased 40 to 50 years ago are still faithfully on the job. Amesteam Generators always incorporate the latest advances in package boiler design.

Write today for details on these boilers with the proven record of reliability.

**AMES IRON WORKS, INC.**

Box C-85, Oswego, N. Y.

Show me how I can benefit from Ames experience and nation-wide organization in getting a top boiler value.

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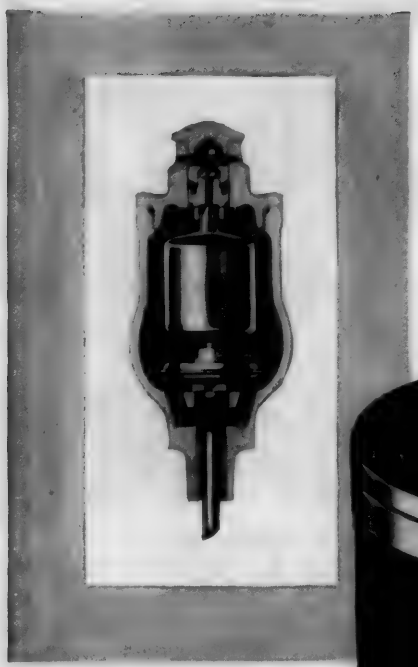

# A well placed air vent can work a heating miracle!

**No. 5 Rapid Vent.** Float and thermostatic construction. Designed for use at the end of steam mains, tops of risers and other similar locations on vapor and one pipe vacuum systems where the maximum venting requirement does not exceed one cubic foot per minute at 5 psi.

**No. 6 Quick Vent.** Thermostatic only. Designed for installation at high points in the piping where there is not sufficient room for the No. 5 Vent or where a float is not needed. Same venting capacity as No. 5.

In a Wilmette Illinois Building, an outwardly well-engineered vacuum system had been a headache for years. Then, last winter, along came a heating man who quickly sized up the situation and said with real conviction: "Put a Marsh No. 5 Vent right there!"

That did it! One inexpensive vent cleaned up a spotty, erratic condition, that a number of expensive alterations had failed to touch.

Unusual? Not in the least: over the years we have seen a lot of wonders worked by installing the right kind of Marsh air vent in the right spot. A number of these dependable vents are illustrated here . . . products that express an unrivaled accumulation of knowledge in dealing with air venting problems.

Marsh air vents are fully covered by the Marsh Heating Specialty Catalog along with Marsh Traps and Valves. Your local Marsh man will be glad to work with you in applying Marsh Vents effectively.

**MARSH HEATING EQUIPMENT CO.**
*Sales Affiliate of Jas. P. Marsh Corporation*
**Dept. U, Skokie, Ill.**

**No. 30 Air Vent.** Float only. Designed to remove air and gases automatically from hot or cold water tanks, coils or piping, liquid pump systems or similar applications where it is necessary to vent air rapidly. Maximum working pressure, 125 psi.

**No. 55 Air Vent.** Float and thermostatic construction. Is capable of expelling large volumes of air without passage of water or steam and is designed for use on steam pressure vessels or systems. Maximum working pressure, 125 psi.

**No. 7 Air Eliminator.** Float and thermostatic construction. Especially suitable for installation at the ends of steam mains, return piping and tops of risers where it is necessary to expel a large volume of air from the system. Suitable for working pressures up to 15 psi.

# MARSH

*Quality Heating Specialties since 1865*

# The **best** cellars feature Chase® Copper Tube

Cellar to attic—all through the house—you cut installation time of water lines when you use Chase copper water tube!

Rugged Chase copper tube is lightweight, easier to handle. Cut it to required length quickly, right on the job. Make leakproof solder joints without time-consuming threading—*fewer* joints, because Chase copper tube comes in 20 foot lengths.

At the same time, you assure customer satisfaction with lines that give *more* years of trouble-free service! Chase copper tube *resists* corrosion—can't clog with rust. Its smoother inside surface cuts friction to a minimum and assures a fast and efficient discharge of fixtures.

Add *extra-quality* to every job at *little or no extra cost!* Install hot and cold water lines of Chase copper water tube. Your Chase wholesaler has full stocks on hand.

*Chase copper drainage lines, too, give superior service over the years... add extra-value to any home!*

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# . . . Say "Trane"—and

**Trane Wall Line Convectors** combine *low initial cost* with *low installation cost* to meet even the tightest heating budgets. Designed for attractive wall-to-wall applications in schools, office buildings, hospitals and institutions . . . wherever *high capacity* and *economy* are a must. Unusually rugged construction with extra reinforcements and full back. Over-all cabinet heights 14″, 20″, 26″; depths 4″ and 6″; lengths to 72″.

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*Nation's most complete line of fin-type radiation simplifies specifications and maintenance... concentrates responsibility.*

**CHURCH ROOM OR CLASSROOM,** hospital, home or factory—no matter what type of building or where—*no matter what type of radiation*—this one-source supply can cut design time and help you plan better.

Specifications are simplified, maintenance made easier. And the reason is simple. TRANE manufactures the nation's most complete line of fin-type radiation, so *you* can concentrate responsibility in *one* reliable source.

Since 1925 TRANE has led the way in developing and improving a broad line of radiation products. You can depend on TRANE quality and TRANE ratings in job after job after job. TRANE product literature is complete, easy to use.

So on your next job—say "TRANE." Call your nearby TRANE Sales Office, or write TRANE, La Crosse, Wisconsin.

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**MANUFACTURING ENGINEERS**

*One source, one responsibility for:*
*Air Conditioning • Heating • Ventilating*
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**Perco-Flo heaters** block cold air, stop drafts.

**Model H & P unit heaters** put heat where you want it.

**Torrider heaters** deliver large volumes of air long distances.

**Steam Specialties** include full line of valves, traps, vents.

**Trane Wall-Fin** brings draft-free heating to long wall and window areas. Large tube diameters make it especially suitable for loop systems where pressure drop is critical. Use single element where capacity requirements are low, multi-tiered elements where high capacity per lineal foot is required. Sloping-top cabinets or expanded metal grilles. Choice of 1¼" or 2" steel or 1" or 1¼" nominal copper elements.

**Trane Convectors** combine efficiency with compactness and beauty. Aluminum-copper heating element responds quickly, provides heat instantly . . . eliminates wasteful overheating common to other types of radiation. Ideal for homes, offices, institutions. Can be installed free-standing, recessed or wall-hung. 21 cabinet styles with flat or sloping tops. Knob or chain dampers optional.

**Trane Baseboard Convectors** assure your homeowner clients greater comfort by heating where the cold begins —along *outer* walls, *under* windows. Give greater freedom of furniture arrangement, add beauty to any home. And they may be installed up to 50% faster because cabinet and coil come preassembled, closures *snap* together. Nonferrous heating element. 8¼" and 12" heights.

# Radiant Heating Used to Provide Maximum Comfort for Cerebral Palsy Patients

A complete radiant heating system of USS National Steel Pipe has been installed at the Walter D. Matheny School for Cerebral Palsy Children, Peapack, N. J., to insure heating comfort for the patients and to keep operating costs of the institution at an efficient low.

The majority of the pipe used in private rooms was ¾-inch standard. Supply mains through the hallways were laid in sizes up to 2 inches diam.

In installations such as this, where dependability, efficiency and economy are the prime considerations, architects and contractors almost inevitably turn to National Pipe. They have been specifying National, in fact, for over 60 years as the "standard" for conventional plumbing and heating systems. And why not? National Steel Pipe has every characteristic necessary to meet the requirements of such applications—smooth, uniform bending; sound, strong welding properties; and long service life. These are the characteristics that have made National the largest selling pipe in the world.

Write *now* for complete details on the use of USS National Steel Pipe for radiant heating and snow melting applications. Ask for Bulletin No. 19. And keep National in mind for your next installation.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
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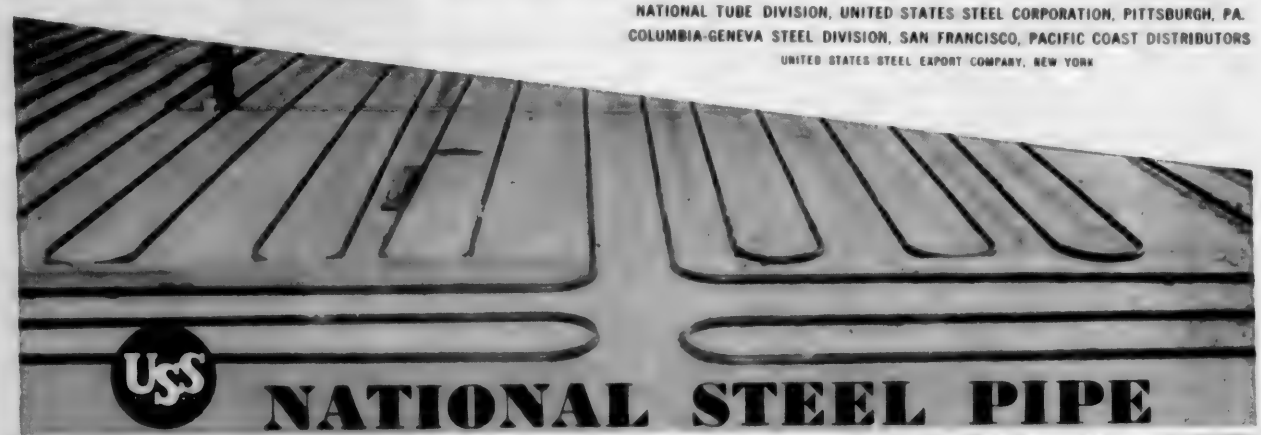
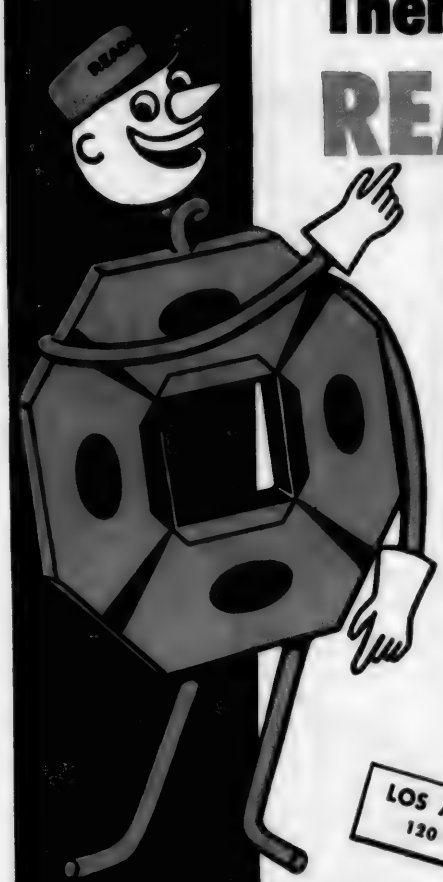


# Mr. JOBBER...



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. . . don't play "Blind Man's Buff"

Compare **QUALITY . . .** and you'll choose **MARLO** cooling towers

1. Accurately balanced, double-width—double-air inlet, forward curved, hot galvanized centrifugal wheels and No. 16 gauge volute scrolls, mastic coated for extra corrosion resistance.
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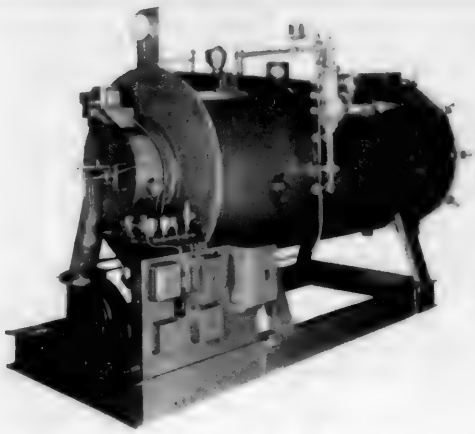
**Quality Air Conditioning and Heat Transfer Equipment Since 1925**

# only YORK-POWER [illegible]



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Steam Generators —
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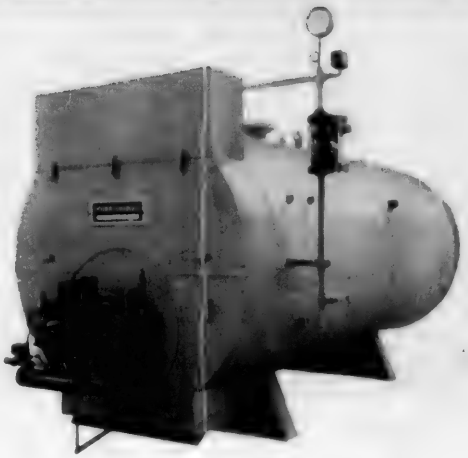
High or Low Pressure
Oil and/or Gas Fired



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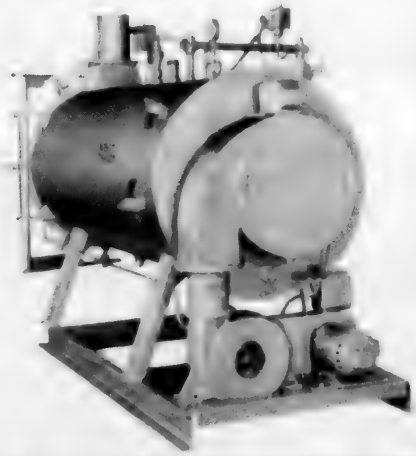
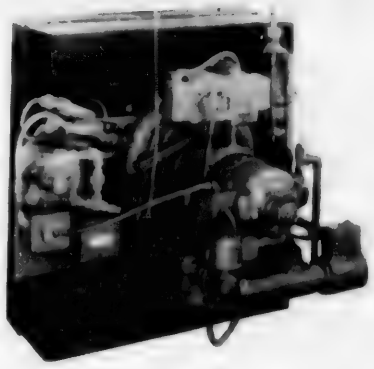


**STEAM-PAKETTE**
Packaged
Steam Generators —
15 to 30 Horsepower
High or Low Pressure
Oil and/or Gas Fired



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Burners (45 to 400 Hp.),
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Detailed Specifications Data on York-Power Equipment will be furnished on request. Dealership Openings Available in certain key markets.

**INDUSTRIAL DIVISION**

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This recently completed housing development at Flushing, N. Y., is called the Mitchell Cooperative Apartments. Beth-Co-Weld steel pipe was used extensively for the plumbing and heating lines. *Contractor:* Jarcho Bros., Long Island City, N. Y.; *Jobber:* Chas. F. Guyon, Inc., New York.

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For any type of residential or industrial construction, Beth-Co-Weld is ideal steel pipe for general-purpose applications.

Beth-Co-Weld is good, reliable pipe for plumbing and heating lines because it is made from sound steel by the continuous-weld process. It's uniform pipe in every way—in quality, in physical characteristics, and in strength of weld.

Your jobber stocks Beth-Co-Weld steel pipe in sizes from ½ in. to 3 in., standard-weight and extra-strong, in random lengths, and in 21-ft uniform lengths, plus or minus 1 in. He also furnishes Beth-Co-Weld in 3½ and 4 in., standard weight only, in lengths of approximately 22 ft.

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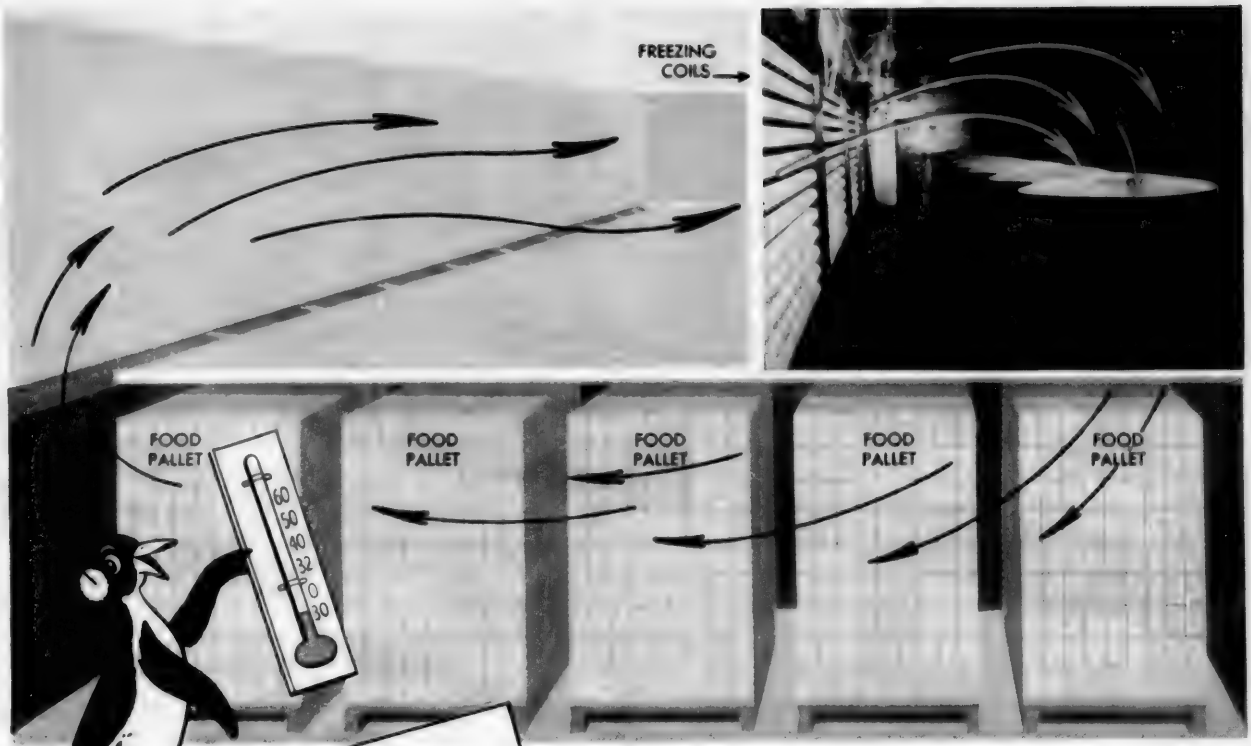
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Miles of Beth-Co-Weld are used in heating and plumbing lines at new Mercy-Douglass Hospital, Philadelphia. *Contractor:* L. E. Winter Co; *Jobber:* C. J. Rainear and Co., Inc., both of Philadelphia.

BETHLEHEM STEEL

## BETH-CO-WELD STEEL PIPE




# JOY
## ® AXIVANE FANS HANDLE SEVERE QUICK-FREEZE JOB

A West Coast quick-freezing plant boasts an effective operation that utilizes 24 Joy 7½ HP Series 1000 Axivane Fans, installed in two groups of 12 each.

Note the illustration above. The upper floor contains freezing coils and a row of 12 fans. The floor below is partitioned into narrow freezing tunnels, each served independently by a single Joy fan.

As air passes through the freezing coils, it is cooled to between —30° and —35°. This sub-zero air is propelled down and through the tunnels below, which contain pallets of meat, vegetables, fruit, etc. to be quick-frozen. After passing over the food, the air is again cooled and circulated. At full plant load, each 12-fan battery handles 242,000 CFM of air.

The relatively quiet operation, light weight, compactness and low power consumption of Joy Axivane Fans—due to the unmatched efficiency of their vaneaxial design—have proved *real* advantages on this job. Their in-line construction also saves space, since each fan can be mounted right in its short, vertical duct. In addition, extreme flexibility of operation is made possible by the adjustable blades, a standard Joy feature. ● Let us help you to get best results on your fan problems. ***Joy Manufacturing Company, Oliver Bldg., Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

*Left: Looking up from the quick-freeze room below a Joy Axivane Fan. Note the compact, economical use of space and the simple mounting.*

*Consult a Joy Engineer*

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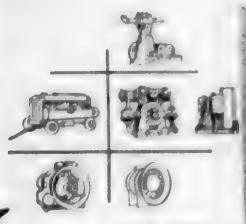

WBD 1 4466

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SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1905

# CUSTOM WEBSTER WALVECTOR

## Designed into the Building

**Custom Webster Walvector, used beneath windows, becomes an integrated sill . . . eliminates the need for plastering or other finishing of walls behind the enclosure. Custom Webster Walvector is custom-made to meet modern architectural design and construction requirements . . . is designed into the building construction . . . yet is sufficiently standardized to permit production on an economical basis.**

Custom Webster Walvector utilizes the proven principles of Webster Tru-Perimeter heating comfort . . . circles all exposed walls . . . gives clean, gentle, even warmth, without cold spots, hot spots or drafts. But Custom Webster Walvector goes beyond the limitations of standardized production to provide a tailor-made, built-in heating system that effects substantial savings in construction costs.

Enclosures are available in eight basic types, for wall mounting or with integral sill, with either front or top outlet, and for single or double row heating element . . . custom-made to required dimensions, in any increment of length.

For details call your Webster Representative, or write us.

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**WARREN WEBSTER & COMPANY**

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**Webster WALVECTOR**

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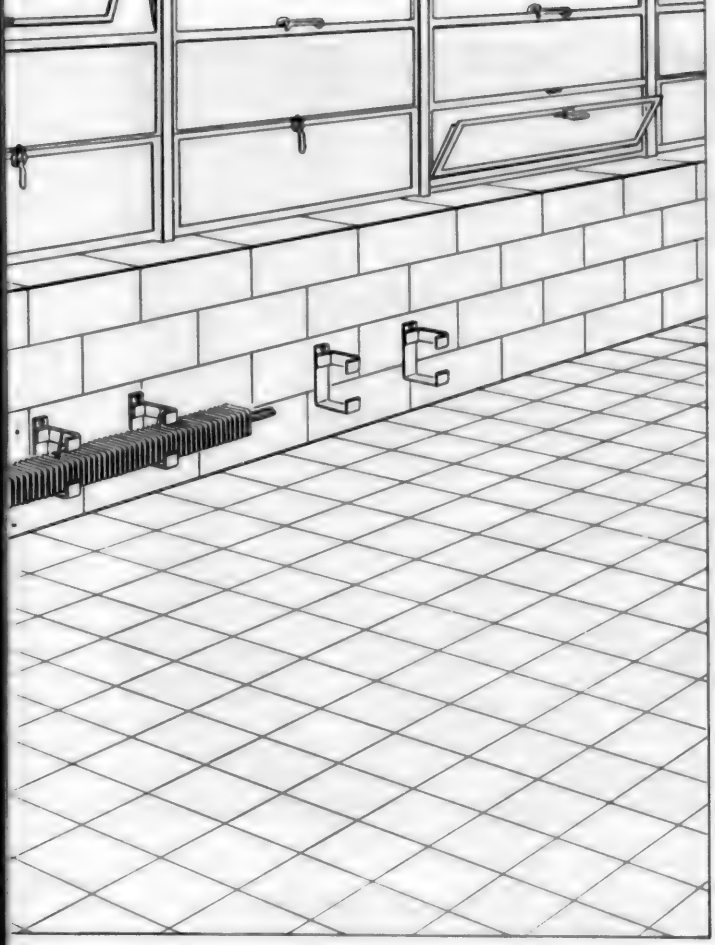
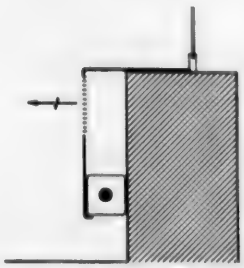
**For Steam or Hot Water Heating**

AND **Webster also makes Standard Walvector, Webster Baseboard Heating, and Convector Radiation; Heating and Process Steam Specialties; Moderator Controls for Steam Heating; Hydro-Heat Hot Water Specialties and Controls; and Unit Heaters for steam, hot water or gas. Data on request.**

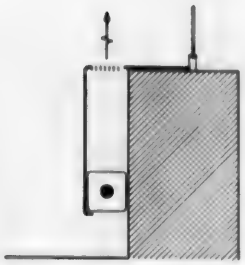


Type CF. Front outlet for wall mounting for 3" or 4" heating elements.

Type CT. Top outlet for wall mounting for 3" or 4" heating elements.



Type CFS. Front outlet integral sill for 3" or 4" heating elements.



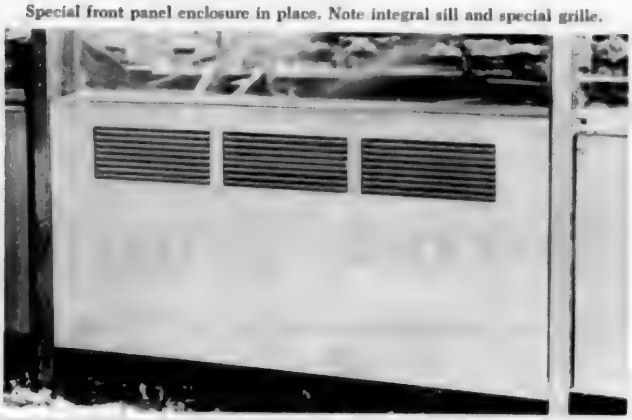
Type CTS. Top outlet integral sill for 3" or 4" heating elements.

# Custom Webster Walvector Construction Progress Views

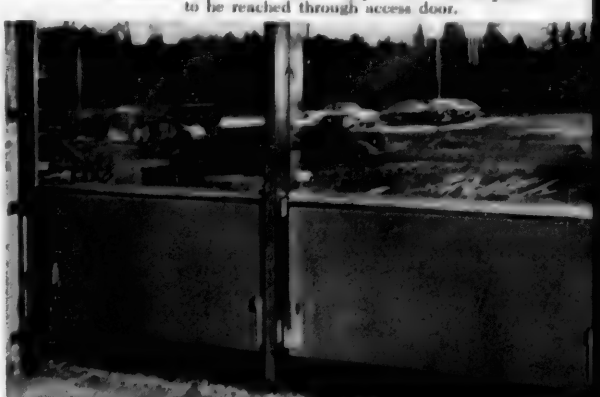
Back plate, brackets and heating element in place.

Installation complete with enclosure having grilled lower inlet and top outlet grille.

Special front panel enclosure in place. Note integral sill and special grille.



Brackets in place on insulating panel. Valve in place to be reached through access door.



G E HAS THE ANSWER TO AIR CONDITIONING PROBLEMS IN ANY STORE, OFFICE, OR FACTORY

One of four operating rooms at Mercy Hospital in Canton, Ohio. These, with sterilizing room, make up five zones that are "comfort serviced" all year 'round by two 5 ton G-E Packaged Air Conditioners.

# HOSPITAL AIR CONDITIONS OPERATING ROOMS... SAVES ON EQUIPMENT, DUCTWORK, SPACE

**Heat-gain and heat-loss studies** showed that 16 tons of air conditioning were required for the four operating rooms, one sterilizing room of Mercy Hospital in Canton, Ohio. But Niagara Heating Co., local G-E contractors, found a way to give the effect of this tonnage with only two 5 ton G-E units—*saved the cost of six tons* by feeding water from the Hospital's own well to a preconditioning coil and then to the G-E units. Duct runs were minimized by locating G-E units in doctors' rest area, handy to operating rooms. Space requirement: only 34 square feet. Larger equipment would have entailed roof installation and much higher costs. Write for data to: General Electric Co., Commercial and Industrial Air Conditioning Dept., 5 Lawrence Street, Bloomfield, N. J.

**Simple, space-saving installation.** Compact size of G-E units permitted their location in the lounge of the doctors' rest area—no space wasted—no long duct runs.

Safety and sanitation are of paramount importance in installations of this type. It is recommended that the services of a consulting engineer generally be employed in this kind of application.

## G-E PACKAGED AIR CONDITIONERS OFFER MORE:

- *Low installation, low operating costs.*
- *Gives the architect maximum design freedom. Units can be used in space or concealed, with or without ducts.*
- *Streamlined cabinet styling. Adds to decor of any interior.*
- *3, 5, 7½, 10 and 15 ton units can be used singly or in multiple to meet air conditioning needs of any building.*
- *Easily directed airflow for no-draft, no-waste air circulation.*
- *Muggy Weather Control removes excess moisture in any weather without over-chilling or clammy cooling.*
- *Built and factory assembled by General Electric. 5-year warranty covers entire sealed cooling system.*

# Packaged AIR CONDITIONERS

*Progress Is Our Most Important Product*

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**FULLY AUTOMATIC**
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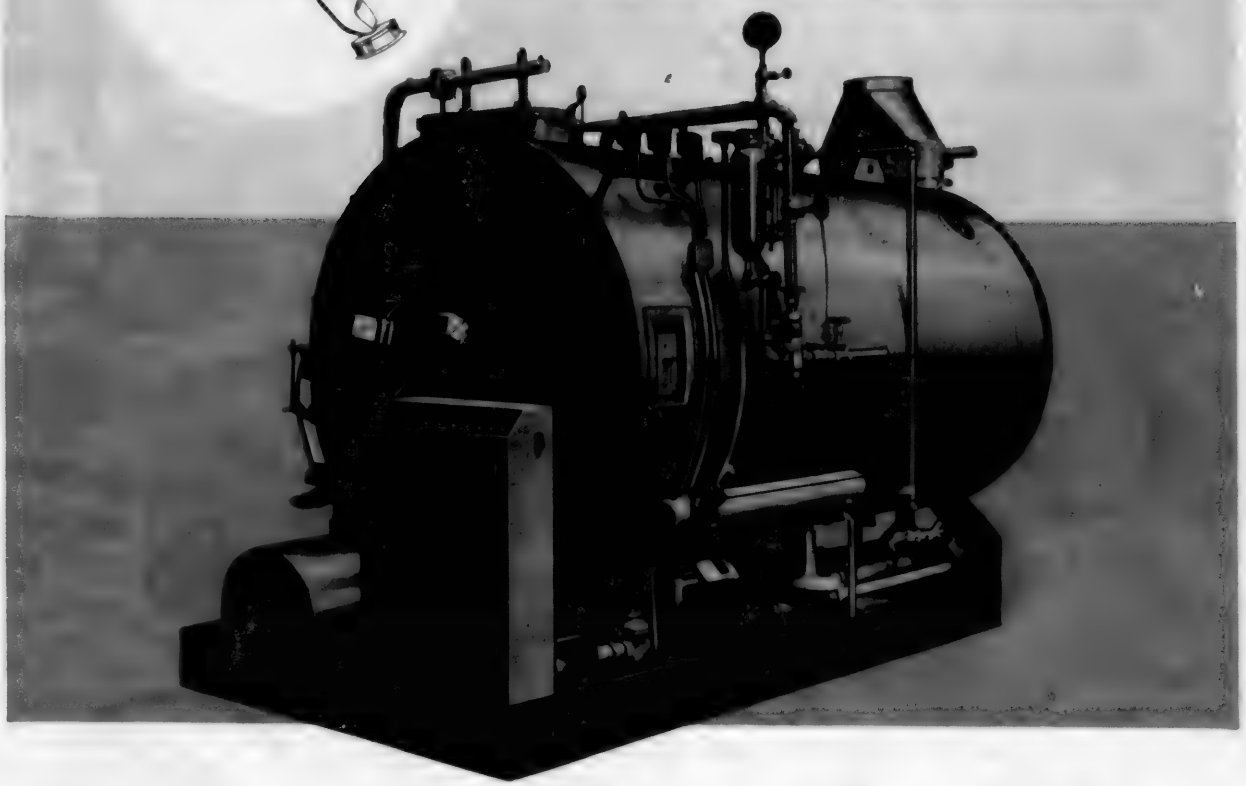

# Titusville TICOSTEAM

## PACKAGE STEAM GENERATOR

Push-button controlled from a single station mounted integral with the boiler, every step in the operation of Titusville's TICOSTEAM Generator is automatic, simple, dependable and fully safeguarded. This modern, compact package steam generator is complete in every respect—finished, tested and certified at the factory, ready for your service. Operating with heavy or light oils, straight gas, or combination oil and gas, TICOSTEAM Generators are available in capacities from 2070 to 10,350 lbs. of steam per hour. Ask for descriptive Bulletin B-3100.

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*Quality Piping Systems . . .*
*. . . of Exceptionally High Thermal Efficiency*

RIC-WIL INCORPORATED
PREFABRICATED INSULATED PIPING SYSTEMS
BARBERTON, OHIO

## Design fundamentals of the

# ALL-AIR HIGH VELOCITY distribution system

By F. J. KURTH | *Vice President of Engineering*

*Anemostat Corporation of America*

A national survey reveals that today, more than ever, engineers are studying, learning and using high velocity-high temperature differential air distribution. Here is a brief discussion of the advantages of the all-air high velocity system over conventional and mixed cycle (air and water) systems.

**1. No Coils — No Clogging — No Odor**—There are no coils in the all-air high velocity units. Damp coils collect lint and emit dank odors, and the coils must be cleaned periodically.

**2. No Individual Fans — Filters — or Electric Motors** — The all-air units operate entirely with air which is processed in the main equipment rooms. The 100% induction units utilize the kinetic energy of the high velocity air to mix primary air with the room air.

**3. No Conflict of Trades**—The all-air units are installed by the sheet metal trades only.

**4. More Effective Use of Outside Air in Spring and Fall**—More primary air is delivered to the all-air units than to induction coil units. This allows the engineers to operate in the Spring and Fall on outside air and thereby save refrigeration.

All-air high velocity units offer scientific air diffusion. Each high velocity unit is provided with an aspirating or high induction type air diffuser which is scientifically designed to diffuse air without drafts. Each unit can be pressure balanced by an easy-to-operate balancing device and a calibrated orifice. In fact, the Anemostat all-air high velocity system can be balanced more accurately than other systems and in less than half the time required to balance a low velocity system.

High velocity units require practically no maintenance after installation. They have valves of the non-corrosive, die-cast, "rocket-socket" type, which are patented by the Anemostat Corporation of America. All units can be adapted for the following variations:

1. Single duct for zone control or individual thermostatic or manual remote control.

2. Dual duct for thermostatic control or any other type of control.

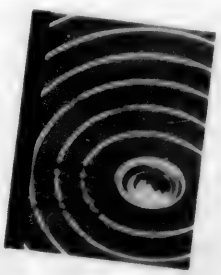
3. Single or dual duct units with the diffuser fastened to the unit, or remote from the attenuating unit.

4. Under-the-window, sidewall or ceiling type installations.

5. Can be provided with standard aspirating diffusers or 100% induction type diffusers.

6. Induction type units handle temperature differentials up to 33° below ambient.

### *Selection Manual Contains Data on High Velocity Units*



New Selection Manual 50 gives extensive selection and application data on high velocity all-air distribution systems. Write on your business letterhead for Selection Manual 50 to the Anemostat Corporation of America, 10 E. 39 Street, New York 16, New York.

# THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS

## *It's the Nash* CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

**NASH ENGINEERING COMPANY**
**438 WILSON, SO. NORWALK, CONN.**

# Facilities for a Medical School and Research Center

WILLIAM GARDBANE
Assistant Plumbing Trade Chief, Syska & Hennessey, Inc., Consulting Engineers, New York, N. Y.

**Many facilities, some not found in other types of buildings, are required for a medical school and research center. With these facilities there must be flexibility in operation to permit changes necessary to keep abreast with the latest ideas in medical research. The various facilities installed are described and figures given on use factors for each type service in the building.**

MECHANICAL systems for medical schools call for more than the conventional heating, ventilating and plumbing. A close study must be made of the medical school requirements to design properly the many facilities that are needed.

To illustrate some of the facilities that must be included and also some of the design considerations, attention is directed to the Medical Science Building of the New York University Bellevue Medical Center in New York City.

New York University divided its medical teaching and research work among several buildings. With the need for expansion came the idea for a consolidated center. A 4-block area was obtained north of Bellevue Hospital and preliminary designs were completed in 1948 to include a 4-story Institute of Rehabilitation, a 20-story University Hospital and Laboratory, a 7-story Medical Science Building, a 2-story Alumni Hall, and a 16-story Hall of Residence, all interconnected into one unit as shown in outline in Fig. 1.

The Medical Science Building is T-shaped, and is actually three buildings in one, consisting of medical research (including post graduate research), Berg Institute of Animal Research, and the medical school. Berg Institute is served from the central machinery room, and has a separate entrance and elevator.

The research section of the building has facilities on the ground floor for locker rooms for maintenance and personnel, and for cadaver storage in its northern section with entry from the service court north of the medical school wing. Dining rooms and a temporary electric kitchen in its southern section will be relocated in the future Hall of Residence. The first floor has the administrative offices of the schools, and the second floor and up have research laboratories.

The school section of the building has a library on the ground and first floors, and laboratory classrooms on the second floor and up.

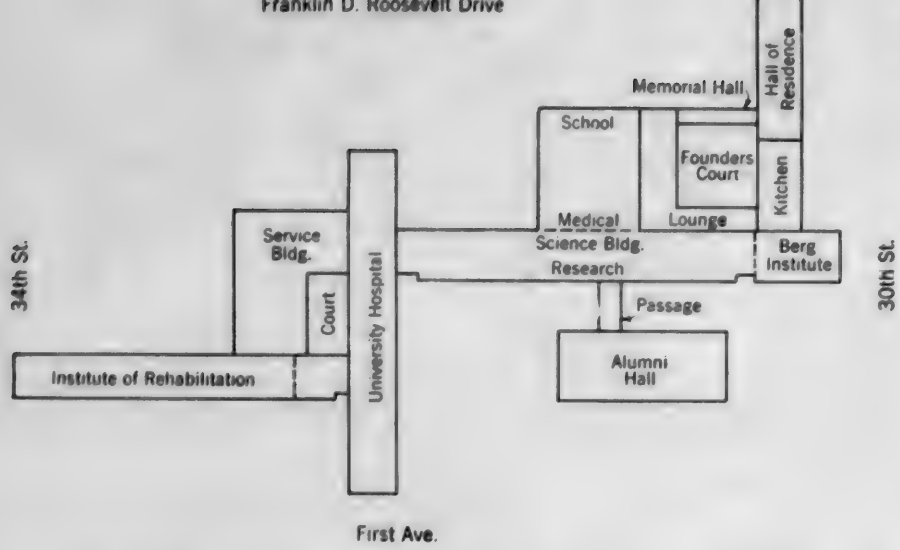



Fig. 1. Plan showing the location of buildings for the New York University Bellevue Medical Center in New York City.

The Berg Institute operates as a single unit and consists of laboratories and animal rooms devoted entirely to animal research.

The entire structure was designed for the addition of two future stories, and mechanical facilities were provided in the cellar machinery rooms for the future University Hospital.

## Flexibility is Necessary

Complete flexibility was desired for the laboratories of the research section, since the requirements of the various departments fluctuate with scientific developments in medicine. For this flexibility, a service shaft was provided in the center of each bay on each side of the corridor, containing risers for all services, with connections at the ceiling of each floor for distribution to the outlets of the equipment on that floor. Steam and drainage lines are exceptions for of necessity they serve the floor above. See Fig. 2. Branch connections are terminated at the control valve or plug outside the shaft for extension to the outlets as required. Therefore, only the one bay is inconvenienced when changes are made to the laboratory layout. Extensions will be at the ceiling with drops being made at the walls in three locations for further extension to the outlets. The drops shown at the right side of the plan in Fig. 2 show a possible modification where a fume hood is installed. Other modifications may be made when the bay is divided to serve two laboratories or when a connecting door is desired between bays. Furred spaces at the columns are provided for supply and exhaust ventilation ducts to serve fume hoods. Supply air will be served through a diffuser in the wall above the door. Air will be exhausted through the fume hood located adjacent to the duct shaft.

Sizes for services were calculated on the basis of preliminary laboratory layouts which represented the requirements as of that time. For flexibility, all floor branches were sized as for the largest laboratory, and all risers were sized as for the heaviest calculated load of the preliminary layouts as listed in Table 1.

Because of the limited space available for the supply and exhaust ducts, a high velocity supply air handling system is used. The fume hood exhaust divides into several systems, capable of handling a given number of fume hoods above the initial installation. Even this will not permit installation of a fume hood at every floor of any shaft. However, with judicious planning of laboratory locations, hood requirements may be satisfied, since fume hoods are not required in every laboratory.

Semi-flexibility is desired by the Berg Institute to permit operational changes. This semi-flexibility is included on the same basis as the research section, except, since the institute operates as one unit, a more permanent and economical installation is provided by having the branch extensions at the ceiling below feeding up to the equipment, and terminating the branch and riser at the last outlet with plugs for future extension.

No changes are contemplated for the school wing, therefore, a permanent installation was designed.

## Drainage

Sanitary drainage is accomplished by means of vertical stacks connected to the house drain at the cellar ceiling

**TABLE 1.—SIZE AND NUMBER OF OUTLETS FOR VARIOUS SERVICES**

| Item | Waste Fixture Units | Vent Fixture Units | Cold Water Outlets | Hot Water Outlets | Gas Outlets | Air Outlets | Vacuum Outlets |
|---|---|---|---|---|---|---|---|
| Largest No. connections on branch | 28 | 28 | 17 | 13 | 22 | 10 | 8 |
| Branch size, in. | 3 | 2 | 1¼ | ¾ | 1 | ¾ | ¾ |
| Largest No. connections on stack or riser (1) | 53 | 53 | 45 | 17 | 54 | 24 | 9 |
| Add 40% for two future floors (2) | 21 | 21 | 18 | 7 | 21 | 10 | 4 |
| Total connections on stack or riser (1 & 2) | 74 | 74 | 63 | 24 | 75 | 35 | 13 |
| Stack or riser size, in. | 4 | 3 | 2 | 1¼ | 1¼ | 1 | 1 |

discharging to the 30th Street sewer south of the building. The cellar fixtures discharge to two vented cast iron ejector tanks, one centrally located at the junction of the tee, and the other located at the southern end of Berg Institute. Content of the tanks is then pumped to the house sewer by duplex ejectors. Cast iron soil piping was specified as being best suited to handle the various types of waste matter, with chemical lead piping used for laboratory equipment traps. Silicon cast iron piping was specified for the acid waste system.

Some experiments will be made using radio-active materials. The amount and concentration of these materials being classified information, a representative of the Atomic Energy Commission was consulted concerning the disposal of such wastes. It was his decision that the concentrations used are not considered dangerous and will definitely be harmless after dilution with the rest of the building drainage. However, some means of checking the concentration of this disposed waste is needed. Laboratories for conducting experiments with radio-active materials are localized to two centrally located stacks in the research section and three stacks in the Berg Institute. These stacks are connected to a separate house drain, having its own house trap where such check can be made before discharging to the house sewer.

The drainage system is sized as shown in Table 1. This does not include the stacks which were made 4 in. to permit installation of private toilet rooms on the first floor. There is enough spare in the stack sizes of the soil and vent to accommodate a reasonable number of fixtures on the ground and first floors.

## Drainage of Acid Wastes

The acid waste discharge from laboratory experiments would normally have no serious effect upon the piping system if adequately diluted. Use of acids in research work would be in individual experiments by experienced personnel, so the discharge of concentrated acids will be minimized and avoided. This will not be the case in the school wing where an entire class would dispose of their experiments at one time. Therefore, in addition to a regular drainage system, there is an acid waste system designed for floors assigned to bio-chemistry, pharmacology, and pathology in the school wing of the building, consisting of separate stacks and house drain of acid-resisting pipe discharging to the house sewer through an acid neutralizing sump. To avoid vertical piping rising from island units, which would interfere with proper supervision of the students, advantage was taken of the New York Code permitting omission of back vents in acid systems for schools provided not more than two floors are connected to one stack. There are two acid waste stacks in each shaft of the school wing. This permits one of the future floors to be assigned for acid experiments to connect to the stack now serving one floor.

**TABLE 2.—GAS CONNECTION AND DEMAND SUMMARY**

| Location | Connected Load, Cu Ft/Hr | | (1) Demand Load, Cu Ft/Hr | (2) Use Factor, % | (1) × (2) Cu Ft/Hr |
|---|---|---|---|---|---|
| | Present | Future* | | | |
| Laboratories | 10,000 | 4,500 | 14,500 | 25 | 3,625 |
| Incinerator | 1,100 | | | | |
| Pantries | | 2,500 | 5,350 | 65 | 3,478 |
| Kitchens | | 1,750 | | | |
| Totals | 11,100 | 8,750 | 19,850 | | 7,103 |

*To provide for the balance of the center.

## Drains in School Wing

House drains for the school wing are at the first floor ceiling above the library and are taken down at a location near the junction of the tee of the building to the cellar house drain. At this point on the first floor, a special acid neutralizing sump was installed to neutralize the acid waste discharge from present and future acid drain outlets. The sump is 5 ft diameter and 6 ft 9 in. high. It is placed on dunnage beams to spread the load on the structure, and it is constructed of welded steel plate with Pyroflex, a rubber base synthetic resin, fused to the steel plate

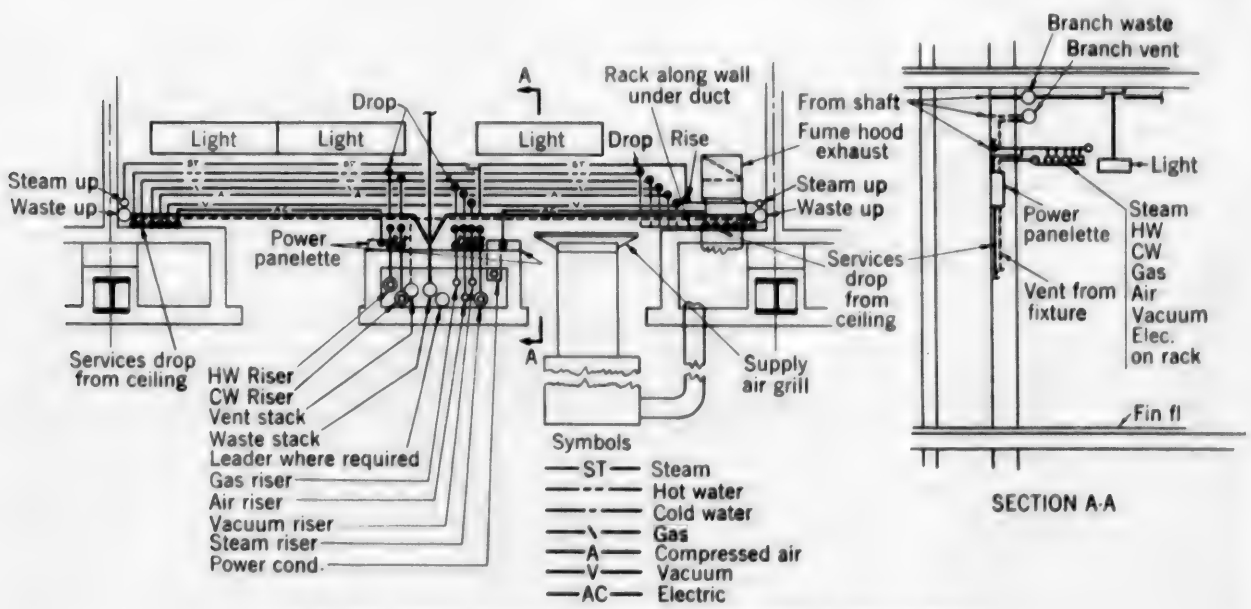



Fig. 2. Plan of typical service connections in the Medical Science Building.

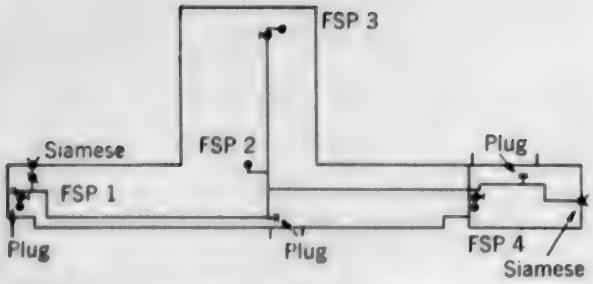



Fig. 3. Connections for the fire standpipe system.

on the inside and through connections. The Pyroflex is sheathed with acid-proof brick laid with acid and alkali-resisting resin cement. The sump was charged up to a point just below the inlet with limestone or marble pieces, 1 to 3-in. in size.

### Domestic Water Supply Systems

Water is supplied through two 8 in. metered services, cross connected inside the building, the west one from First Avenue and the east one from Franklin D. Roosevelt Drive. These services will also supply the future University Hospital. Mains serving the two services are independently fed, thus insuring a constant water supply in case of a shutdown of one of the mains.

Since available pressure in the street mains is inadequate to maintain the required supply to the upper floors of this building, the water is raised by duplex centrifugal pumps, from a header having tees for the future hospital house pumps, to two steel gravity tanks enclosed in a tower above the highest occupied floor of the present structure. Two tanks are used to avoid shutdown of the water supply when the future two stories are added; then these tanks will be relocated to a higher elevation one at a time. Water storage is divided between the two gravity tanks with capacity based on the designed pumping capacity plus reserve for the fire standpipe and sprinkler systems. While the house pumps were selected for their future pumping capacity and head, a smaller impeller was installed for the present needs. Required increased storage for future domestic purposes will be available in the tanks from the present reserve for the fire standpipe system, This reserve will be transferred to the taller hospital building.

Hot water is generated by duplex storage tank heaters, with a storage of 60% of the estimated peak hour demand divided between the two tanks, and each tank having a steam coil capable of making 67% of the estimated peak hour demand. Each coil is full size to better handle the load during breakdowns. This equipment is sized to include the demand of the future two stories.

Type *B* copper tubing with cast brass fittings having silver brazing alloy inserts was used for the water piping, except that galvanized wrought iron pipe with malleable iron fittings was used for cold water piping 5 in. and larger.

Water is distributed at the top floor to risers feeding down through the building. Where the static pressure may exceed 50 psi, pressure, reducer valves are installed; on the riser for cold water, and on the branches for the circulated hot water. The entire system was sized using the Department of Commerce use-curves to establish gpm requirements and yet maintain a velocity under 10 ft per second—generally between 7 and 8 fps. Two fixture units

**TABLE 3.—SUMMARY OF COMPRESSED AIR USE AND SUPPLY**

| Building | Use | Demand, cfm | Use Factor, % | Supplied Cfm Air |
|---|---|---|---|---|
| Medical Science Building | Laboratories | 1,621 | 15 | 243 |
| University Hospital Building | Laboratories | 272 | 18 | 49 |
| | Hospital Outlets | 40 | 100 | 40 |
| Institute of Rehabilitation | Laboratories | 10 | 100 | 10 |
| Heating and ventilating demand | Present | | | 25 |
| | Future | | | 40 |
| | | | Total | 407 |

are allowed in design computations for each cold water laboratory outlet and one fixture unit for each hot water laboratory outlet. A separate street pressure cold water system is installed at the cellar ceiling, serving the cellar and ground floors. This system supplies the large demand for (1) the condensate cooling water in the cellar machinery room, (2) the general toilet rooms on the ground floor, and (3) the kitchen on the ground floor.

### Chilled Drinking Water

A central chilled drinking water system serves the building. Chilled water is fed from a central unit in a cellar machinery room, up through one riser to the top floor where it is distributed to the three other risers, feeding down and circulated back to the central unit. The central unit consists of a cooler served by a 7½ hp Freon compressor and water cooled condenser that can cool 265 gph. Included is a 150 gal storage tank. A cooling tower recirculates the cooling water from the condenser. It has a design capacity to handle a similar central unit for the future University Hospital.

Another separate cold water system is provided to supply water for the flushing-rim floor drains in the animal rooms of Berg Institute. With the small incidence of simultaneous use, a surge tank, fed through a float valve, was installed in the pent house level, centrally located among the risers supplying these fixtures.

A filtered water system serves the microbiology laboratories (second floor) of the research section. Cold water is filtered through three 20 gpm filters (the estimated demand) located on the second floor and is then distributed to the laboratories through the corridor ceiling.

### Fire Protection Systems

Although the entire project is and will be of fireproof construction, supplementary and preventive fire protection are provided, consisting of a fire standpipe system for the buildings, and a sprinkler system for cellar storage rooms and other areas having volatile occupancy.

The Medical Science Building has four 4 in. standpipe risers, fed from the gravity tanks, each having a reserve of 3500 gals for this system. The supply is fed down through one riser to a 6-in. cross connection at the bottom of the building, and up the other risers. The cross connection has plugs provided for future extension to the other units of the center as shown in Fig. 3. Hose stations consist of a 2½ in. hose valve for use by the fire department, connected through a reducer to 1½ in. fire hose on a rack for building personnel. These valves and a 2½ gal water

type fire extinguisher are all enclosed in a recessed type cabinet. This standpipe system will eventually be supplied from gravity tanks on the taller University Hospital as mentioned when describing the water system. Space in the cellar machinery room is allowed for a future fire pump to provide adequate pressure for fire department use in the taller building.

A sprinkler system is installed to protect the cellar storage rooms and the laboratories where experiments are conducted using volatile materials. The system is supplied from a direct connection to a city water main to provide adequate pressure for the upper floors. A reserve of 2500 gals is provided in each gravity tank, feeding the system through a checked dead riser connected to the cross connection at the bottom of the building. A centrally located riser has a valved connection on every floor for extension through the corrider ceiling to the laboratories as required, except a plugged connection is provided on the ground and first floors. The third floor is presently connected to this riser.

### Gas System

Manufactured gas supplied from the utility company's main in First Avenue, has a heat content of 538 Btu per cu ft. This service enters this building at the northern end, a central location for the entire project, and was sized to serve the entire center. Steel pipe with threaded malleable iron fittings were used for this system.

**TABLE 4.—VACUUM AIR SUMMARY**

| Building | Use | Demand, Cfm | Use Factor, % | Cfm Air |
|---|---|---|---|---|
| Medical Science Building | Laboratories | 1,283 | 20 | 257 |
| University Hospital Building | Laboratories | 272 | 20 | 54 |
| | Hospital Outlets* | 106 | 50 | 53 |
| Institute of Rehabilitation | Laboratories | 15 | 100 | 15 |
| | | | Total | 379 |

*Average use factor for 32 operating room outlets, 14 bedside outlets and 60 hospital laboratory outlets.

Laboratory outlets were based on the average consumption of 10 cu ft per hr for a medium size Bunsen burner. All branches in the school wing are sized for 100% use, while the branches in the other laboratories are sized with a use factor of 50%; a use factor of 65% for the risers in the school wing, and 30% for the other risers. Various use factors are used for sizing the mains; 40% for school wing and 25% for the rest of the building. The entire system is sized for a pressure drop of 0.2 in. w.c. back to the meter. Summary of the estimated connected load and demand for the entire center is shown in Table 2.

### Compressed Air and Vacuum Air Systems

Central systems for compressed air and vacuum air were designed for the center. Galvanized steel pipe with threaded malleable iron fittings is used in these systems. All outlets use 1 cfm.

Use factors for sizing the compressed air system are: 70% for school wing branches, 40% for other branches, 40% for school wing risers, 25% for other risers, 40% for school wing mains, and varying 25% to 18% for other mains. Compressed air for the heating-ventilating controls are also supplied from this system.

Use factors for sizing the vacuum air system are: 100% for school wing branches, 50% for other branches, 65% for school wing risers, 50% for other risers, varying 50% to 40% for school wing mains, and varying 50% to 20% for other mains. The lack of reduction of the use factors for the laboratory risers were caused by the concentration of outlets on one branch of the riser.

Compressors and vacuum producer pumps are of the rotary liquid seal, displacement type, with selection based on the summaries shown in Tables 3 and 4. Since present compressed air demand is 243 cfm of 40 psi air, two 225 cfm compressors are installed, one to carry the major part of the load, and the other for standby. Space is provided for a third compressor for future installation at the time of full demand, eventual load being carried by two compressors with the third as standby. Two vacuum-producer

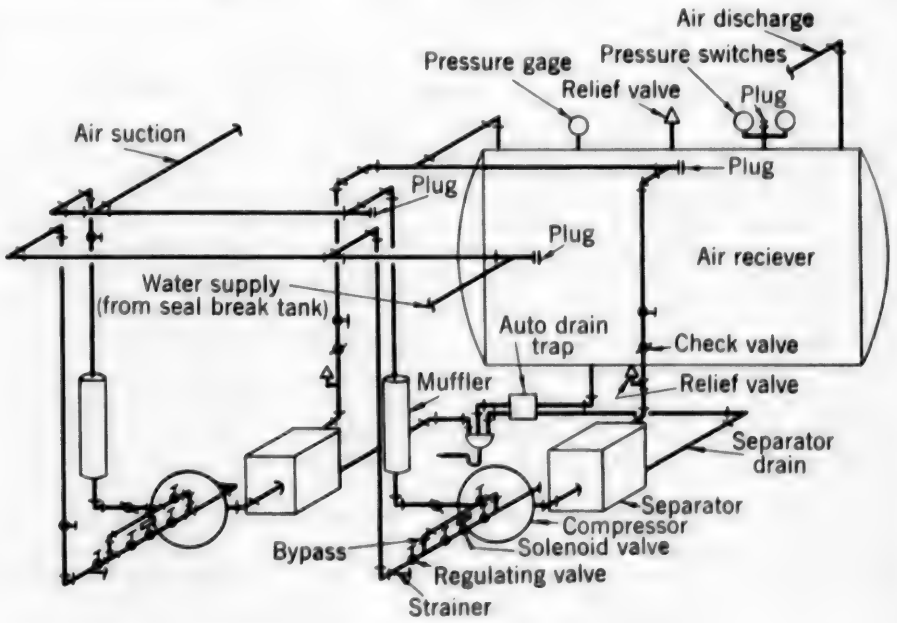



Fig. 4. Schematic arrangement for the compressed air unit and piping.

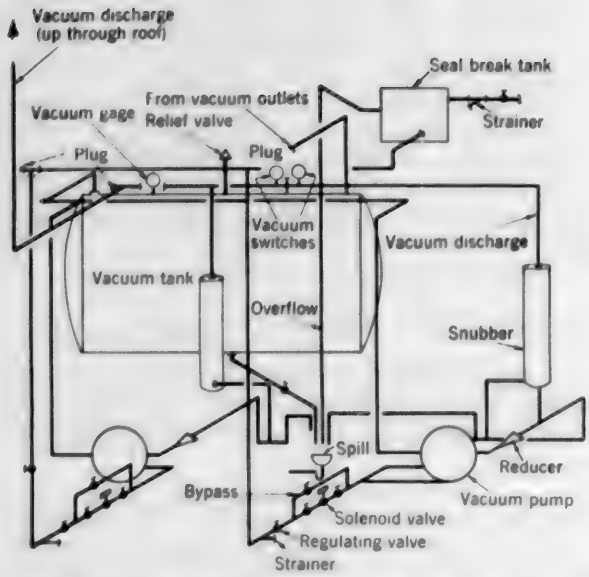



Fig. 5. Schematic for the vacuum pump unit and piping.

pumps are installed for 320 cfm at 20 in. Hg, one to carry the major part of the entire demand, and the other as standby. This was done to take advantage of economical standard equipment sizes. Schematic diagrams of the compressed air and vacuum air equipment installation is shown in Figs. 4 and 5. For isolated centrifuges, a 75 psi compressor unit was also provided.

### Special Systems and Equipment

*Distilled water system.* A distilled water system consisting of one centrally located riser with a dispensing unit on each laboratory floor was provided for an estimated demand of 200 gpd. Located in the penthouse, a duplex 50 gph automatic steam-operated water still was provided with automatic starting, stopping, and flushing controls for maintaining the level in an adjacent 200 gal box type storage tank, and operating either or both stills. All surfaces of the stills and storage tank coming in contact with the distillate is coated with pure block tin. To maintain the purity of the distillate, aluminum pipe with threaded cast aluminum fittings and cast aluminum alloy gate control valves having stainless steel stem and disc are used. Dispensing units were fabricated of stainless steel, of a size to accommodate a standard 5 gal bottle. The supply fixture is a block tin-lined self-closing swing spout faucet.

*Glycerine system.* A system of piping was provided for distributing a mixture of glycerine, carbolic acid, formalin, and alcohol to six outlets in the cadaver storage room. To minimize corrosion, all materials for handling this mixture are of stainless steel conforming with the American Iron and Steel Institute Type 304. A 50 gal storage tank installed as high as possible on the same floor in an adjacent room, is supported by structural members from the floor. To fill this tank, a self-priming electric driven pump is installed across the tank support bracing, at a convenient height for suction from the mixture mixing crock.

*Maceration tank.* A new tank was designed for the maceration work done at the school. This tank is the box type with sliding doors on top, and was fabricated of insulated hollow stainless steel. The tank has water supplied from a swing spout faucet over the top of the unit with thermostatically controlled mixed water. Temperature in the tank during its work process will be maintained by thermostatically controlled immersion type electric heaters installed at the bottom of the tank.

*Degreaser.* For degreasing and drying the product of the maceration tank, a degreasing unit used in the metals industry was adapted. This unit vaporizes a solvent for degreasing and drying, and the used vapor is condensed, cleaned, filtered, and recirculated for re-use. The solvent will be vaporized by automatically controlled immersion type electric heaters. The tank body, into which the product for degreasing is placed in wire baskets, is made of monel metal as is the water jacket condenser around this tank. The solvent storage tank is zinc coated. A ventilating fan mounted on top of the unit exhausts the excess fumes from the unit and discharges it to the atmosphere above the roof.

## Military Hospital is Air Conditioned

Covering a total of 15.9 acres and rising to a height of 17 stories, the central Military Hospital, Bogota, Colombia, will incorporate the very latest in hospital design, equipment, and techniques. Its proposed occupancy was 750 beds, with 250 beds for hospital personnel; however, enlargements are under consideration which will make possible the accommodation of 1,000 patients.

A triangular unit system of architecture was adopted for the building, consisting in placing the patients' rooms along both arms of a triangle, with service areas (rooms for linen, supplies, snack bars, and nurses' stations) located at the apex. The hospital is formed of three such giant 17-story V's, joined arm to arm as follows: VVV. Thus important supplies and equipment are always near at hand to doctors and nurses, without the necessity of traveling long corridors. Vertical connections are four floor-to-floor staircases and six elevators.

From the third basement to the top floor and penthouse, the hospital is served by the circulation of filtered and heated 100% fresh outside air, with no recirculated air used. Five large oil-fired heating units circulate a total of 165,400 cfm, each unit being equipped with thermostatic and humidistatic controls.

Seven Typhoon packaged air conditioning units serve all rooms devoted to surgery, maternity and obstetrics, orthopedics, plastic surgery, and incubation. Two Typhoon 25-ton units, and several others of lesser capacities, are used for this purpose, comprising about 60 tons of air conditioning in all. Since Bogota is 9,000 feet above sea level and remains at moderate temperatures all year round, the air conditioning of these areas serves primarily to maintain stable atmospheric conditions.

The entire central heating, air conditioning, and ventilating system was supplied and installed by the Typhoon Export Corporation.

# Proper Location of Fans

A. N. ROGERS

Sturtevant Division, Westinghouse Electric Corp., Boston, Mass.

**Whether the fan should function as part of a blow-through or a draw-through system is important to the engineer. One system will show a power saving as compared to the power required to operate the other.**

BLOW-THROUGH system or draw-through system? Forced draft or induced draft? Although these are questions that face the engineer, it is a comparatively little recognized fact that when there is a density change within a given system, a fan will consume less power than when it is handling gas at the higher density.

Recognition of this fact can result in considerable power savings in many types of fan applications especially in drying and industrial oven work. In heating or air conditioning systems, over 10% of the power may be saved by arranging the fans to blow through the heating coils and draw through the cooling coils rather than vice versa. There is an added bonus to this type of arrangement in that the least volume of air is passing through the fan itself and in many instances a smaller size fan may be used.

### Illustrative Problem

Take, for example, a system as sketched in Fig. 1, consisting simply of duct work and heating coils. Compare the air horsepower required by Fan *A* blowing cool air into the system and Fan *B* drawing hot air out of the system. The air is heated from 70 deg F to 600 deg F in the system, thus cutting the density in half and doubling the volume. (530 deg absolute to 1060 deg absolute).

Air Horsepower = Volume × pressure × .000158

Therefore:

Air HP for Fan A =

$$13{,}350 \times 2 \text{ in.} \times 0.000158 = 4.20 \text{ hp}$$

Air HP for Fan B =

$$26{,}700 \times 2 \text{ in.} \times 0.000158 = 8.40 \text{ hp}$$

In this system the fan *blowing* the cool air requires only half the air horsepower of the fan *drawing* hot air, a savings of 4.2 hp. Furthermore, Fan *B* would have to be considerably larger to operate at the same efficiency.

The fan handling the greater volume of less dense air consumes the larger amount of power. Therefore, the fan is doing more work per pound of air when the density is lower. This is shown by the horsepower formula:

$$HP = PVK$$

where $K$ is a constant to make the units of the equation consistent. The density effects on power and pressure cancel on a constant pressure rise, and power varies directly with the volume. A graphic representation of the work performed is shown in Fig. 2.

### Analysis of Problem

It is obvious that all energy going into a system must come out. How then do we account for the extra energy put into the draw-through system? The air leaving the draw-through system must be at a higher energy level than that leaving the blow-through system. For this purpose consider the fan to be a heat machine (or compressor) transmitting the power input into the air in the form of heat.

There is a difference of 4.20 hp between the blow-through Fan *A* and draw-through Fan *B*.

$$1 \text{ hp} = 42.4 \text{ Btu per minute}$$

therefore, $4.20 \times 42.4 = 178$ Btu per minute additional energy is being added to the air on the draw-through system.

$$\text{Temperature Difference} = \frac{\text{Btu per min}}{\text{lb air per min} \times C_p}$$

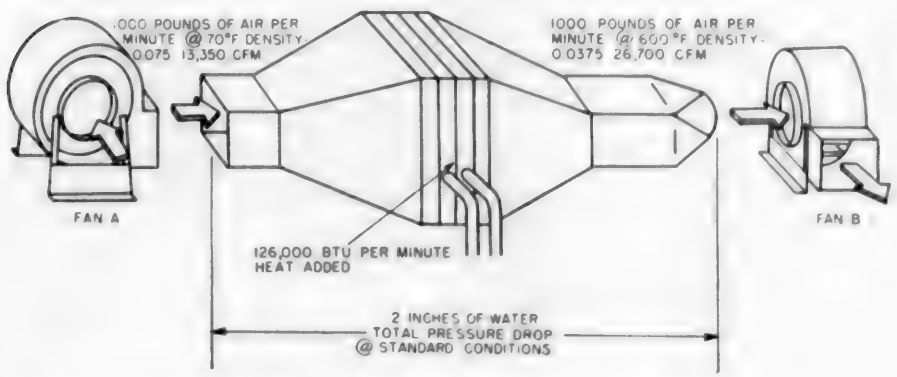

1000 POUNDS OF AIR PER MINUTE @ 70°F DENSITY 0.075 13,350 CFM
1000 POUNDS OF AIR PER MINUTE @ 600°F DENSITY 0.0375 26,700 CFM
FAN A
FAN B
126,000 BTU PER MINUTE HEAT ADDED
2 INCHES OF WATER TOTAL PRESSURE DROP @ STANDARD CONDITIONS

Fig. 1. Sketch of a system consisting of ductwork and heating coils. Either Fan A or B would be used.

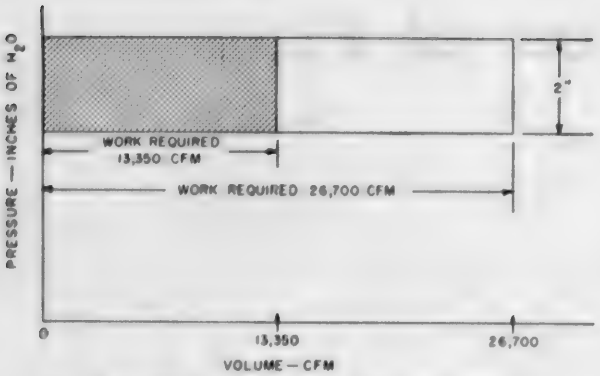



Fig. 2. Graphic representation of the work performed.

where $C_P$ = specific heat of air at constant pressure

$$\text{Temperature Difference} = \frac{178}{1000 \times 0.238} = 0.748 \text{ deg}$$

The air temperature from the draw-through system will be 0.748 deg higher than the blow-through system. This could be checked with a sensitive thermometer assuming the fans to be of equal efficiency.

To make the energy level of the air leaving the blow-through system equal to that of the draw-through system, an extra 178 Btu per minute of heat must be added. Note that this is *not* reversible. That is it is impossible to save 4.20 HP by putting 178 Btu per minute less into the draw-through system.

From the foregoing it may be concluded that, for minimum power consumption, a fan should be placed at a point in the system where the air has the highest density. The example illustrates an extreme case when the power is doubled but even in heating, say, from 0 deg to 90 deg, the power can be reduced 15%. There are, of course, systems where fan location is limited because of other factors such as the possibility of leakage. All other things being equal, however, it is well worth while taking into account the location of the fan.

## Improved Method for Applying Cermets

A rapid, economical process for applying a common type of cermet coating to a metal base is now in use at the National Bureau of Standards. The cermet powder in this case is a chromium-boron-nickel mixture that is combined with a ceramic frit. The process employs ordinary ceramic coating procedures to replace the former flame-spraying method and provides a hard, high-temperature-resistant facing for metal parts. Developed by D. G. Moore and J. R. Cuthill of the Bureau's enameled metals laboratory, the coatings have excellent thermal shock resistance and are reasonably ductile.

Cermets possess properties of both metals and ceramics. The chromium-boron-nickel types have some degree of ductility, are resistant to thermal shock, and oxidation at high temperatures, and retain their strength and hardness at high temperatures as well. In recent years, chromium-boron-nickel layers have been used extensively as hard facings for metal parts, subjected to the severe conditions of erosion and oxidation. In one commonly-used process, the chromium-boron-nickel powder is flame-sprayed onto the metal part. This overlay is then fused to the base metal with an oxy-acetylene torch. The resulting layer is dense and well-bonded but has several disadvantages. First, it tends to be expensive for large-scale production; second, the flame-spray technique is unsuited to the coating of cylindrical parts of small inside diameter; third, the process is not feasible where thin layers, about .002 in., are required. To overcome these objections, the Bureau undertook a study of other methods of applying chromium-boron-nickel cermets. So far, the use of ordinary ceramic coating procedures appears to be the most successful.

In the NBS process, a slip is prepared from a cermet powder and a ceramic frit. However, instead of flame-spraying the material, the usual ceramic coating procedure is followed and the slip is applied to the metal part at room temperature by either dipping or spraying. The part is then fired at a temperature above the melting point of both the cermet and the frit. During the firing the ceramic phase in the coating serves as a flux to permit welding of the cermet particles without the necessity of a highly-purified, oxygen-free atmosphere. Depending on the firing temperature, the ceramic material either "sweats out" to the surface or remains as occlusions in the cermet network, while the cermet particles melt to form a continuous layer that becomes brazed to the surface of the basis metal.

In one series of experiments, coatings with different ratios of frit to cermet powder were prepared and applied to various basis metals. It was discovered that the sweating out of the glassy phase to the surface of the cermet layer occurred at a firing temperature of 1900 deg F for coatings which contained 5, 10, or 20 parts by weight of frit. However, a temperature of 2100 deg was required before sweating out occurred with a coating which contained 50 parts by weight of frit. In the cases where sweating out did not occur at all, the glassy phase was found to be enmeshed in a welded network of the cermet material.

Firing time had little effect on the appearance of the coatings; a coating appears the same after 16 minutes of firing as it does after 2 minutes. Firing in air gave satisfactory coatings on alloys that initially had good oxidation resistance, but a furnace atmosphere of low oxygen content was necessary to achieve satisfactory protection on such metals as molybdenum, ingot iron, and several low-alloy steels.

Neither thorough cleaning nor roughening of the metal surface prior to applying the coating was essential. Satisfactory coatings were obtained on smooth surfaces which had been only mildly degreased before applying the slip.

The coating with the best continuity of the Cr-B-Ni layer, and with the best appearance, was obtained from a mixture of 10 parts of frit, 90 parts of cermet powder, and 5 parts of clay by weight. This coating was designated M-60. With this mixture, coating thicknesses in the range of 0.004 to 0.008 in. can be achieved by single-coat application. For thicknesses greater than this range, multiple coatings are recommended. For thinner coatings, finer grinding of the slip is required.

How one manufacturer tested and applied epoxy-resin coating to water treatment equipment.

Plastic dipped tanks entering and leaving curing oven.

# New Plastic Guards Tanks Against Corrosion

J. D. ROPER

President, Roper Manufacturing Co., El Monte, Calif.

EPOXY resins, only a few years old but already in wide use throughout industry, are finding their way into the heating and ventilating field. Suitably formulated with a curing agent, they are being applied to water softeners, storage tanks, and water heaters with singular success in preventing corrosion.

Several tests were conducted to determine the physical characteristics of the lining. To evaluate thermal shock resistance we coated a ⅛-inch hot rolled steel panel so that film thickness of the cured coating was 1 mil. The panel was then heated to 600 deg F, and held at that temperature for 15 minutes. Panels were withdrawn from the oven and, without giving them a chance to cool, were plunged into cold water. This treatment had no effect on the coating; no signs of chipping, crazing, or cracking were noted.

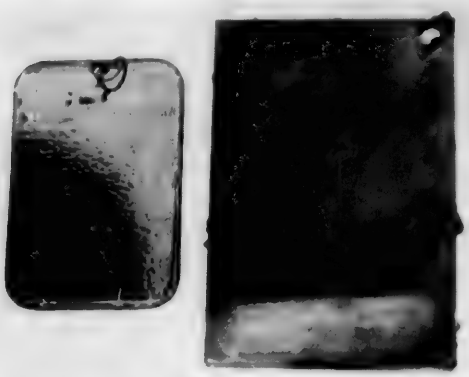


Fig. 1. Epon resin formulation on steel panel at left, held at 190 deg F for two years, blistered slightly but did not rupture. Porcelain coated panel at right, after same exposure, shows rust spots in center.

Similarly, because of the coating's tenacious adhesion to steel, accidental denting of a tank will not cause a break in the lining. A coated panel of boiler plate stock was bent through an arc of 180 degrees, using a ½-inch mandrel. A standard epoxy coating, 1 mil thick, did not spall or chip or flake off the steel.

This lining, formulated from Epon* 1007 resin by the Trail Chemical Company of El Monte, California, has also been tested on a steel panel held at 190 deg in an autoclave for more than two years. Another steel panel, coated with a high quality porcelain was checked right along with it. At the end of the test, large rust spots could be found in the center of the porcelain panel. The resin-based coating, on the other hand, showed small blisters but no film rupture or loss of gloss, as shown in Fig. 1. The fact that this coating was as glossy at the end of the test as it was at the beginning indicated that the coating would continue to protect the panel to which it had been applied.

Immersion tests show that the lining resists acids, organic chlorides, detergents, and salt spray, both at room

*Shell Chemical Corp.

**TABLE 1—RESISTANCE OF EPOXY RESIN FORMULATION TO VARIOUS REAGENTS**

(1-mil coating is unaffected by three months' immersion in the following reagent concentrations in water at room temperature.)

Miscellaneous Reagents

liquid detergent (100%)
liquid detergent (50%)
solid detergent (1%)
sodium methoxide (40% in methanol)
sodium chlorite (25%)
sodium hypochloride (5%)
calcium hypochloride (5%)
Ferric chloride (5%)
water
saturated salt vapor at 100 F for 500 hours

Acids

acetic acid (1%)
linseed fatty acids
sulfuric acid (up to 75%)
hydrochloric acid (up to 25%)
nitric acid (up to 10%)
phosphoric acid (up to 85%)

Bases

sodium hydroxide (all conc.)
ammonium hydroxide (10%)

Alcohols

ethyl alcohol
isopropyl alcohol
secondary butyl alcohol
n-butyl alcohol
methyl isobutyl alcohol
diacetone alcohol
hexylene glycol
glycerine

Organic Chlorides

carbon tetrachloride
allyl chloride

Cyclic Hydrocarbons

toluene
xylene

Ketones & Aldehydes

methyl isobutyl ketone
formaldehyde (30%)

Ethers

diethyl ether
bis (β-chloroethyl) ether

(At higher temperatures, chemical resistance of the coating is also good. It is unaffected by the materials listed below, exposure being at 150 deg for three weeks unless otherwise noted.)

isopropyl alcohol
secondary butyl alcohol
methyl isobutyl carbinol
diacetone alcohol
hexylene glycol
methyl isobutyl ketone
allyl chloride
20% sodium hydroxide (boiling, 24 hrs)
73% sodium hydroxide (280 F, 2 weeks)
glycerine
glycerine (170 F, 6 weeks)
water

and elevated temperatures. Table 1 gives a more complete listing.

## Method of Application

The success of any coating depends to a very large degree on the cleanliness of the surface to which it is applied. At the Roper plant, it was found that thorough sandblasting of tank components (Fig. 2) just before welding gave better results than a chemical bath and rinse.

Fig. 2. Tank components are sand-blasted prior to assembly and dipping.

Fig. 3. Electronic gage checks coating thickness.

Welded tanks are completely submerged in a high temperature curing epoxy formulation for 10 minutes and are withdrawn slowly to avoid sags or runs in the coating. Threads in the tank are not protected, but are reamed and re-tapped after the coating has been cured.

After an 8-minute drain period, tanks are sent through a gas-fired curing oven, where they are held at 500 deg for about 13 minutes. The cured coating comes out a light greenish brown. As soon as tanks have cooled sufficiently, they are rerouted through the dipping vat a second time to assure complete coating and a film thickness heavy enough to withstand normal wear. The second cure, also at 500 deg, takes 21 minutes, after which the coating has turned a deep, rich brown. Completed tanks are allowed to cool for about 22 minutes.

The thickness of the final cured film must be at least 1 mil, and is usually close to 1½ mil. Quality control at Roper is checked with an electronic gage (Fig. 3).

## Advantages of a Plastic Lining

Laboratory tests indicate that the cured coating will stand up almost indefinitely under normal use. Navy salt spray tests, run for 2000 continuous hours, have had no apparent ill effects on the coating. Its resistance to alkaline solution is also very high. Immersion of half a panel in 180 F water left no mark, not even at the water surface line. Finally, plastic-coated tanks filled with sulfuric acid held their contents for months without leaking. Table 1 shows the materials successfully contained by the film.

Plastic-coated tanks and porcelain finished ones, have essentially the same resistance to corrosion caused by water or chemicals, although the plastic coat was better able to withstand extreme thermal shock. Another important advantage shared with porcelain is that the baked epoxy coating does not impart any taste or odor to water.

Laboratory tests have been fully corroborated by results in the field. More than 30,000 tanks have been delivered in three years with no complaints to date. Even though the cost to coat a tank is slightly higher than other methods, the resin liner seems worthwhile.

AIR CONDITIONING, HEATING AND VENTILATING'S

Reference Section

# Sampling and Analyzing Air for Contaminants

LESLIE SILVERMAN

Associate Professor of Industrial Hygiene Engineering, Harvard University, School of Public Health, Boston, Mass.

**Procedures are described for sampling and analyzing gases, vapors and particulate matter present as air contaminants in work places. Included are extensive tables on collection methods and analysis, and direct chemical reaction devices.**

**AIR CONDITIONING, HEATING AND VENTILATING — AUGUST, 1955**

# Sampling and Analyzing Air for Contaminants

LESLIE SILVERMAN

Associate Professor of Industrial Hygiene Engineering, Harvard University, School of Public Health, Boston, Mass.

**The intensity and frequency of analyzing air in work places has progressively increased in recent years. The widespread introduction of new and different chemicals has created a need for new and different sampling and analytical methods. A discussion is presented of air contaminants in work places, their influence on sampling and analytical methods to be employed, and sampling procedures. Sampling devices are described for gases and vapors as well as particulate matter.**

SAMPLING and analyzing air for contaminants in work places is a problem which has occupied the efforts of several hundred people for the last fifty years. The intensity and frequency of analyzing air in work places has progressively increased in recent years and the widespread introduction of new and different chemicals has created a need for new and different sampling and analytical methods.

For air sampling purposes, the contaminants as they occur can be grouped into characteristics which they may have in regard to their solubility and vapor pressure. Gases and vapors may be grouped as follows and are so enumerated in Table 1:

1. Gases and vapors which are water soluble or miscible and which can therefore be collected in water.

2. Gases and vapors which are not water soluble but are soluble or highly reactive in other agents and can be absorbed or will react readily with a particular solvent or agent.

3. Gases and vapors which are not water soluble and which slowly react with absorbing agents and therefore require much more treatment for collection.

Dusts may be grouped into the following categories:

1. Relatively insoluble mineral dusts such as silica, granite, asbestos and insoluble metal oxides.

2. Soluble mineral dusts such as limestone or dolomite which are soluble in water or weak acids.

3. Organic dusts which may or may not be affected by water such as trinitrotoluene (TNT), dichlorodiphenyl-trichlorethane (DDT), flour, soap, leather, wood, plastics or other insecticides. These dusts are usually explosive if the concentration in air is high enough.

Fumes, smokes and mists are usually considered in the same category as dust although it is necessary to classify them into groups depending upon the type of analysis required. If a particulate enumeration is desired one type of sampling equipment is applicable; if a total mass evaluation is to be used then another may be employed. In some instances both kinds may require evaluation.

## Introduction to Sampling

The general problem of air sampling has always been concerned with what is the purpose of the sampling. Industrial air sampling is intended to appraise and evaluate the environment as regards to hygienic standards; or sometimes to measure contamination from a process for purposes of studying that process; or the performance of a given piece of equipment used to control the process. In some instances another important reason for air sampling is to ascertain whether or not an explosive concentration exists. Explosive concentrations are considerably higher than those used for hygienic standards and the concentrations of toxic or non-toxic gases within the explosive range are either anesthetic or asphyxial. The problem of sampling air in workrooms and analyzing the collected sample has been the result of the desire on the part of industry to maintain comfortable and safe working atmospheres as well as to comply with established codes of good practice which have legal authority. Most of the reasons for sampling can be summed up into a statement that what previously was desirable has now become law and must be complied with in order to provide good working conditions.

It was an early concept that the sampling of workroom air should be correlated directly with breathing rates of the workers. In fact, some of the early sampling techniques employed devices which were actually operated by the workmen and it is still a good point to bear in mind that the analysis of a respirator pad or a chemical cartridge as used in a given exposure is a good integrated sample of the air which has been filtered in passing to the worker's lungs.

It is also important to emphasize that the problem of biological sampling should not be overlooked.

Industrial air analysis techniques have shown that there is no need to sample air at values comparable to breathing rates of workers nor is there any direct relationship of sample taken to the volume of air breathed by the worker. *It is important, however, that the sample collected be representative of the working environment and that it be weighted in direct proportion to the time the worker spends at various operations.* It should be noted that not all sampling is done with regard to the worker, as mentioned, but may be done in order to check the performance of equipment or machines. For this reason, the type of sampling may be influenced by the actual need for an application to be made of the sample.

## Methods of Sampling

The volume of the sample to be collected in industrial air sampling is primarily dependent upon an estimate of

**TABLE 1—PRINCIPAL COLLECTION METHODS FOR AIR CONTAMINANTS**

| Contaminant | Principle | Apparatus | Collecting Agent | Sampling Rate Range | Collection Efficiency Range | Remarks |
|---|---|---|---|---|---|---|
| Gases or vapors water soluble or miscible[1] and sometimes[3]. | Absorption with simple washing. | Petri bottle<br>Wash bottle<br>Drechsel bottle<br>Impinger | Water, acid, alkali or organic solvent. | 1 to 5 liters per min (lpm) | 90 to 100% | Two units in series can be used for highly reactive gases[2] in other reagents. |
| Gases or vapors of all types. Mists and fumes. | Absorption with multiple contact washing by dispersing gas into fine bubbles of large surface area. | Fritted or sintered glass, alundum, stainless steel or plastics. | Water, acid, alkali or organic solvents. | 1 to 15 lpm depending upon flask and sintered surface dimensions. | 95 to 100% | May plug if large particulates are present or precipitates form from reactions. Fumes require very slow rates. |
| Gases or vapors of all types. Mists. | Absorption with multiple contact provided by wetted surfaces. | Packed columns of glass beads, glass spirals or fibers. Plastic packing also feasible in some cases. Large surface wall area units such as Milligan washer or air-lift pump fall into this group also. | Water, acids, alkali or organic solvents. | 1 to 5 lpm | 90 to 100% | May incorporate device for continually wetting column. High loadings of particulates may plug unit with packing. |
| Gases or vapors[1] and sometimes[2]. | Absorption with multiple surface contact by atomizing liquid with spray nozzle or jet impaction. | Crabtree ozone analyzer or midget Venturi scrubber. | Water, acid or alkali. | 5 to 25 lpm | 60 to 100% | Venturi scrubber satisfactory if dust is present. Atomizer absorber will plug. |
| Combustible gases or vapors[3]. | Combustion and absorption. | Quartz or ceramic furnace with absorbers. 1 or 2 above. | Water, acid or alkali. | 1 to 5 lpm | 90 to 100% | Can also be used for organic halogenated fumes. |
| Gases or vapors[3]. | Condensation. | Freezing traps or low temperature condensers. Glass or metal. | Dry | 1 to 5 lpm | 90 to 100%. Depends on vapor pressures at reduced temperature. | Can be packed with glass beads or other extended surfaces. |
| Dusts, fumes, smokes and mists (aerosols in general). | Filtration | Filter papers or webs, sugar tubes, salicylic acid glass beads, sand. | Dry | 1 to 50 lpm | 85 to 100%. Depends on particle size of aerosol values stated for usual encountered. | Wide variety of media now available in plastic, refractory or soluble fibers. |
| Dusts, fumes, smokes or mists. | Impingement or impaction on dry or greased surface. | Konimeter, Owens, Bausch & Lomb, Impactor. | Dry or greased slides. Silicone coating may be used. | 1 to 30 lpm | 80 to 100% | Sonic velocity can result in high efficiencies. |
| Dust, fumes, smokes or mists. | Impingement with washing. | Impinger, large or midget. | Water, acid, organic reagents. | 1 to 37 lpm | 60 to 100%. Depends on particle size and velocity employed. | Same as above. |
| Dust, fumes, smokes or mists. | 1. Electrical precipitation<br>2. Thermal precipitation | 1. Electrostatic precipitator<br>2. Thermal precipitator | Metal or glass surface.<br>Glass surface | 1 to 85 lpm<br>8 ml/min to 20 lpm | 95 to 100%<br>90 to 100% | Inefficient for particles 10μ. Efficiency falls off on particles greater than 5μ. |
| Dust, fumes, smokes or mists. | 1. Settling<br>2. Centrifugal | Settling chamber<br>Midget cyclone or labyrinth | Metal or glass surface.<br>Metal or glass surface. | Instantaneous<br>1 to 50 lpm | 99 to 100%<br>60 to 100% | Limited to small sample volumes.<br>Efficiency highly dependent on particle size and inlet velocity. |

1, 2, 3 refer to gas and vapor classification on page 88.

the amount of material to be found in the atmosphere. This becomes a somewhat difficult problem and has a very distinct bearing on the type of analysis to be employed. In general, it can be stated that the volume of sample to be collected will depend upon the analytical or physical method to be used and the hygienic standard or M.A.C. (maximum allowable concentration) value, if one is available. If not, an estimate must be made by the observer as to the range in which he expects his sample to be. With a judicious safety factor (four or five times this value) he can be fairly sure of obtaining enough to analyze. By using the maximum allowable concentration or hygienic standard and the least detectable amount satisfactorily analyzed, a value of the minimum volume of air to be sampled can thus be ascertained. This presents no real problem in the case of dusts where (1) a particle enumeration is employed for evaluation but is a problem where a weight analysis of particulate matter

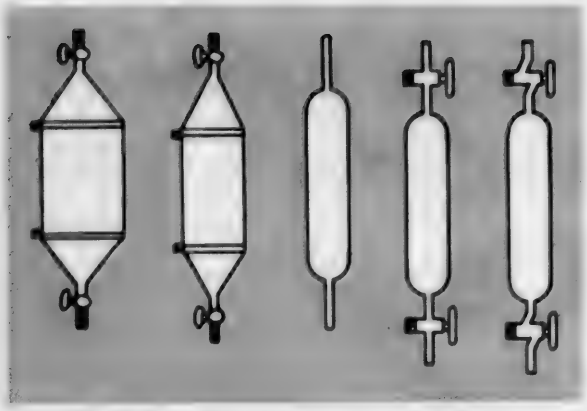


Fig. 1. Grab or instantaneous sampling flasks.

is necessary or (2) with gas and vapor exposures where a weight concentration is desired.

### Gases and Vapors

Gases and vapors offer the least difficulty in air sampling problems in view of the fact that they follow the normal laws of diffusion and mix freely with the general atmosphere and can, in a short time, become thoroughly diffused and at equilibrium. Of course, gases and vapors are influenced by room air currents and cross-drafts as are dust samples. However, they are not affected by such factors as gravity and electrostatic forces which may disturb particulate clouds.

We divide the samples of air taken for industrial purposes into two major groups, one called instantaneous, spot, snap, or grab samples and the other, integrated or continuous samples.

Instantaneous samples are usually collected by means of evacuated flasks which may range in size from a few cubic centimeters to 250 or 300 milliliters and these may be constructed of glass, metal, or plastic as shown in Fig. 1. The maximum volume which can be obtained by the instantaneous sample is influenced by the portability of the collectors and this factor usually limits such samples to a maximum of 300 ml. It is also a question as to whether a sample can be collected instantaneously if much larger volumes are taken in this manner. In practice, the evacuation may be done in the laboratory and the sample opened in the field to collect the gas in the environment or the sample may be purged in the field by a pump, Fig. 2.

The various drawings in Fig. 2. show:

A. Using evacuated flask to obtain sample.
B. Rubber bulb which may be used to draw contaminated air into sample flask *A* or force this air into flask *C*.
D. Magnesia bottle commonly used for grab sampling.
E. Single tube method of drawing sample air into bottle using aspirator bulb.
F. Using two-hole stopper and bulb for sampling. Rubber sampling line may be connected to elbow for remote samples.
G. Inverted magnesia bottle as carried when being returned to the laboratory. A small mercury pool at the bottom of the flask forms an air-tight seal over the porcelain stopper when the flask is inverted. This procedure is not satisfactory for gases which react with mercury.
H. Method of taking continuous sample with grab flask by means of water displacement.
I. Additional tube provided to give constant rate sampling when grab flasks are employed as in *H*.
J. Aspirator bottle for collecting large gas volumes or for drawing a continuous sample through an absorber (see Fig. 3).
K. Siphon bottle for similar purpose as *J*.
L. Large all-glass syringe (50 or 100 ml.) for use in grab or continuous sampling. Reagent may be added directly as shown. After collection, the open end is capped with a syringe cap or a rubber policeman.
M. Method of adding reagent to grab sample flask by means of capillary funnel. Flask is held in hand by means of a wet cloth to shrink flask air volume preventing sample displacement.
N. Similar technique to *M*, but using a syringe filled with a long needle which is thrust through stopcock bore.

Grab or instantaneous sample flasks have been used in a continuous fashion by steadily purging them with a pump. However, a sample in this case contains an average dilution factor; dilution which follows the variations in room air concentrations. The early portion of the sample will predominate should it have been of higher or lower concentration since successive dilution is a logarithmic function. Should the atmosphere remain constant over the period of sampling, then the collected volume will be representative of the average, and truly represents an integrated equivalent.

In the case of integrated sampling, the rate will be dependent entirely upon the type of collection employed, the contaminant involved and the capacity and perform-

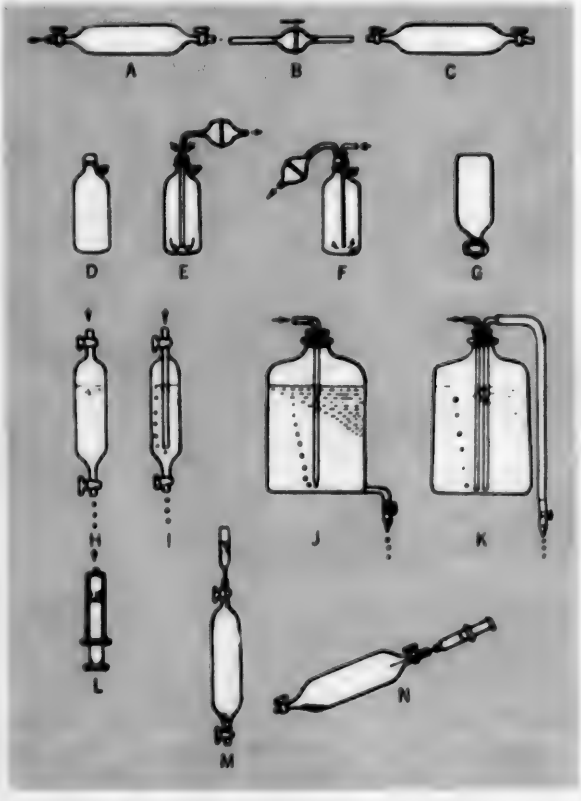



Fig. 2. Methods of obtaining grab samples.

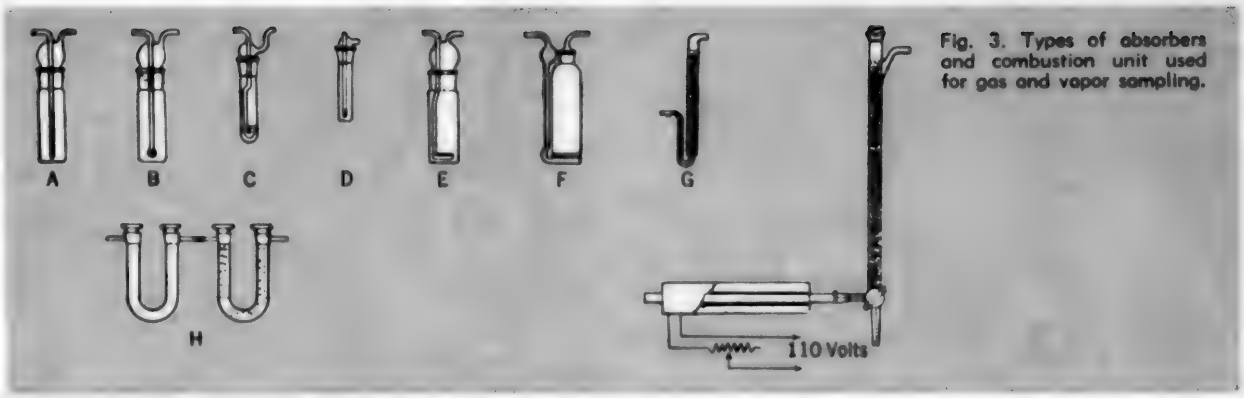



Fig. 3. Types of absorbers and combustion unit used for gas and vapor sampling.

ance of the equipment. It makes very little difference whether a few milliliters or several cubic meters per minute are collected. In most cases, the volume of sample is limited by the capacity of equipment and most air sampling devices for gases are in the range of 1 cfm or less. However, with the sensitive analytical methods now employed, this imposes no handicap and in many instances a few milliliters provides enough at very low M.A.C. values. If large volumes per unit time are taken (cubic meters per minute) care must be observed to see that the sampler is not functioning as an exhauster.

One of the most important factors in the collection of all atmospheric contaminants is the efficiency of the collecting device for the particular contaminant in question. In many cases the answer to this problem is still unavailable since complete performance of all collected devices has not yet been established. The desired efficiency need not be 100%; as long is it is constant and reproducible, it should preferably be above 80%. In most cases, the efficiency of collection for methods recommended in this paper will be considered individually and the optimum sampling rate will be stated. The chief advantage of the grab sampling or instantaneous method is the fact that its efficiency is normally considered 100% if correction is made for completeness of container evacuation.

### Particulate Matter

The collection of particulate matter may be divided as in the case of gases, into two groups, instantaneous or grab samples and integrated samples. The instantaneous sample is ordinarily taken by rapid movement of a plunger collecting a fixed volume of particulate matter in a chamber or by impinging on a plate or surface collecting device. The volume of sample taken is entirely dependent upon the method of analysis to be used. As stated, if enumeration techniques are employed, very little sample is necessary since the numbers of particles in outdoor atmospheres run into several hundred thousand per cubic foot and in contaminated workrooms are even higher. Instantaneous samples are usually limited to dusts but fumes, mists and smokes may be sampled by this method if a satisfactory collecting unit is employed. There is no reason why an evacuated flask of the type of gas sampling device mentioned cannot be used for instantaneous samples of particulate matter in air. The settling chamber is a comparable form of this device. The major consideration is the question as to whether or not some of the sample might be disturbed on entering the apparatus and be collected on the walls of the entering tube to the collecting device.

Integrated or continuous samples of particulate matter will be dependent upon the nature and physical properties of the particles to be collected. In general, the most important factors are their size or mass and concentration. However, several physical forces such as gravity, impaction, electrostatic charge, thermal repulsion and diffusion may be employed for collection. The particle size usually predicts the type of equipment to be employed and the concentration, the volume of sample and rate to be used in collection. In subsequent sections considerable discussion will be given of the type of devices used for both gases and vapors and particulate matter. As mentioned, the type of collecting device will be dependent upon the reactivity and nature of the gas and vapor or dependent upon the particle size and composition of the particulate.

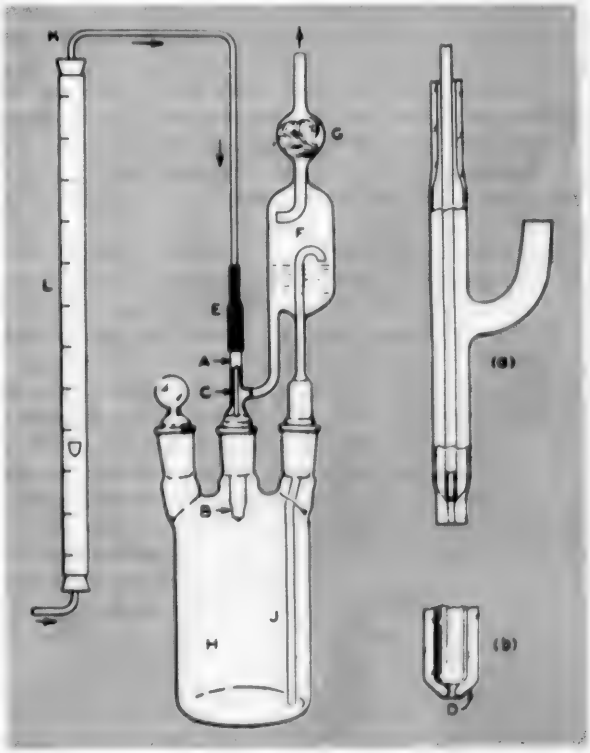



Fig. 4. Atomizing type unit used for ozone sampling (from Crabtree and Kemp, Bell Telephone Lab.) (a) Details of aspirating nozzle for recirculation of absorbing reagent. (b) Details of nozzle tip.

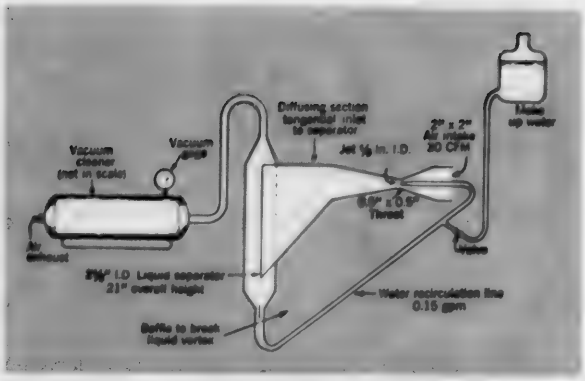



Fig. 5. Venturi scrubber unit for rapid sampling of gas or particulate volume up to 20 cfm. (After P. L. Mabill, et al, Stanford Research Institute).

## Absorbers for Sampling

Absorbers for gases and vapors vary in characteristics depending upon the gas or vapor encountered. In Fig. 3 to 5, the various devices used for collection of gases and vapors are shown in detail.

In Fig. 3, the various drawings are marked *A* to *I*, and their explanations follow:

A. Simple wash bottle with ground glass joint for collecting readily soluble or easily absorbed gases and vapors; 50 to 100 ml. reagent capacity.

B. Gas washing bottle with multi-hole disperser for easily absorbed gases and vapors (50 to 100 ml. reagent capacity).

C. Sintered micro-gas washing flask for collecting gases and vapors not easily absorbed. Gas disperser is a fused powdered glass filter with a pore size of 10-25 microns and produces a myriad of fine bubbles (10 to 25 ml. reagent capacity).

D. All-glass midget impinger flask fitted with a glass-filter stick for the same purpose as *C*. These flasks are interchangeable with ground glass stoppered impinger nozzles, 10 to 20 ml. reagent capacity.

E. Large sintered gas washing bottle (50 to 100 ml. reagent capacity).

F. Large sintered gas washing bottle. The larger diameter filter permits higher rates of gas flow, whereas units *C*, *D* and *E* are for ½ to 2 liters per minute; this unit will permit rates as high as 15 liters per minute with ordinary motor-driven pumps.

G. Multi-surface gas or vapor absorbing tube. The large diameter tube is filled with 4.5 mm. glass beads which are wetted with the absorbing reagent. The gas or vapor is drawn through the capillary tube on the left and out at the top. The sampling rate does not exceed 20 to 30 ml. per minute.

H. Ground glass U-tubes filled with absorbent activated charcoal or silica gel for determining solvents by gravimeteric or chemical procedures. Sampling rate ½ to 1 liter per minute.

I. Large size glass bead absorbing column and combustion furnace as used for sampling halongenated hydrocarbons or sulfur compounds. Air samples or grab samples are displaced through the quartz tube furnace which has a platinum foil catalyst and are broken down to halogen acid and absorbed on reagent coating on glass beads. Sampling rate 1 to 2 liters per minute.

As indicated in Table 1, the main collection methods and apparatus used for both gases and particulate matter may be divided into several groups, most of them covering the devices now employed in practice.

It is apparent from Table 1 that absorption can utilize simple scrubbing or bubbling devices and there are numerous types in addition to those shown which can accomplish this. The table indicates the methods and application. These devices are available from many of the manufacturers whose apparatus and instruments are included in this compendium. When multiple contact washing or multi-surface contact is required, it is done by dispersing gas into fine bubbles or spreading the liquid on to a large surface area by using glass beads or multiple wetted walls. Another approach to break the collecting liquid into fine droplets is by action of the gas or by an atomizing principle using an incorporated ejector pump or atomizer, and providing the extended surface necessary for gas reaction by this technique. See Fig. 4.

Figure 4 notes 11 parts of the device. These are described briefly as follows: *A*, aspirating section; *B*, spray nozzle; *C*, spray nozzle entry tube; *D*, nozzle tip; *E*, connector to rotameter; *F*, aspirated fluid reservoir; *G*, glass wool carryover trap; *H*, two-liter flask; *J*, aspiration connection to sump at bottom of flask; *K*, rotameter connector; *L*, rotameter, 0-5 liters per minute.

Where it is desired to collect insoluble or non-reactive vapors, adsorption or condensation are usually the methods of choice. Adsorbents commonly used in practice in 6 to 20 mesh sizes include: Activated charcoal, silica gel, and special impregnated gels which may contain a reactant for specific gases such as cupramite for ammonia. In many instances it may be necessary to condense the contaminant at low temperature bath with a dry ice and acetone or cellosolve bath. Such devices are ordinarily not considered portable in the field but may be necessary, in certain cases, where the gas or vapor to be sampled can be altered by collection in liquid or is difficult to collect. Essentially, the trap is as shown in Fig. 5 and consists merely of low temperature surfaces which can be extended

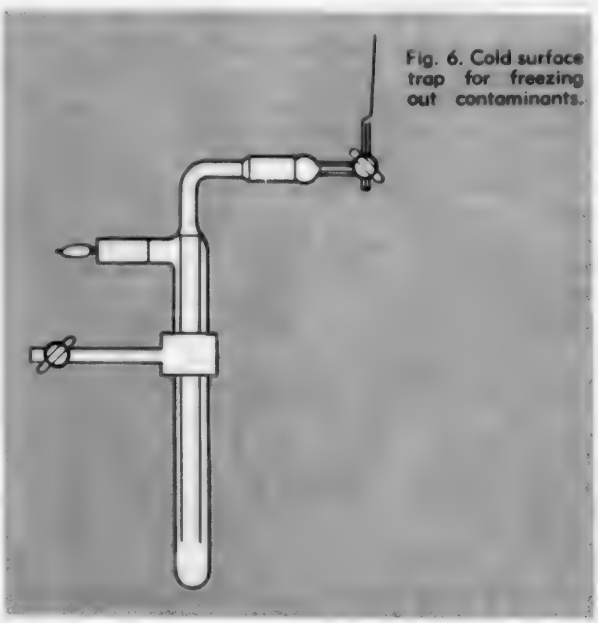


Fig. 6. Cold surface trap for freezing out contaminants.

by the use of glass beads if desired. Normally, simply smooth condensing surfaces are employed.

In many instances it is desirable to burn the gas or vapor in a furnace and sample oxidation products. For example, in collecting or analyzing chlorinated hydrocarbons, combustion is a frequently used method since the gas must either be changed during the sampling or subsequently after the sample is returned to the laboratory. Direct oxidation has the advantage of providing analysis in the field, if desired, although the sample may be taken and burned or wet oxidative methods used in the laboratory. Combustion devices for field application are limited usually to atmospheres which do not have potential combustion or explosion hazards present.

## Collecting Devices for Particulate Matter

In the case of particulate matter we divide collecting devices into the following categories: Settling chambers, centrifugal devices, impingers and impactors, scrubbers, filters and filter media, electrostatic precipitators, and thermal precipitators.

Some of the devices mentioned as used for gases and vapors can be applied to particulate matter. Simple absorbers or all-glass filters may serve as good particulate matter collecting devices and can be applied to liquid aerosols such as mists and fogs.

*Settling chambers.* Primarily settling devices consist of chambers which may be opened to the atmosphere and rapidly closed after getting a representative air volume which is equivalent to grab samples for gases. The major difference here is that the trapped sample is allowed to settle and collect on a glass slide.

*Centrifugal devices.* These devices, such as small cyclones or curved surface traps, of which the helical or spiral sampler is a good example, utilize a grease coated surface or film on which the dust may be collected. The labyrinth is a typical centrifugal-settling combination.

*Impingers and impactors.* These are devices in which impingement or impaction is used as the principle of collection. The continuous impinger, shown in Fig. 7, consists of a glass nozzle submerged in water, the velocity at the nozzle conforming to a given flow rate (large impinger, 113 meters per second, midget 60 meters per second). Impactors consist of impingement stages with varying velocities in order to cause cascading or separation. They may also consist of rods or cylinders of different diameter to provide size separation rather than quantitative recovery of all material.

*Scrubbers.* The type scrubbers used may be the same as those used for gas collection but ordinarily when dealing with particulate material, the type utilizing atomization of the liquid is preferred. Essentially, these are scale models of commercial air cleaning equipment. See Fig. 5.

*Filters and filter media.* One of the ideal methods of sampling particulate matter is through filters and filter media. They now can be produced to various specifications and will collect particulates with minimal auxiliary equipment. A wide variety of filter media are available and another paper in this compendium discusses these at length. The recent development of the Millipore media makes certain problems in air sampling simpler since this provides a surface filter which can be made transparent. This permits particles to be identified in the state in which they were removed from the atmosphere. The same media

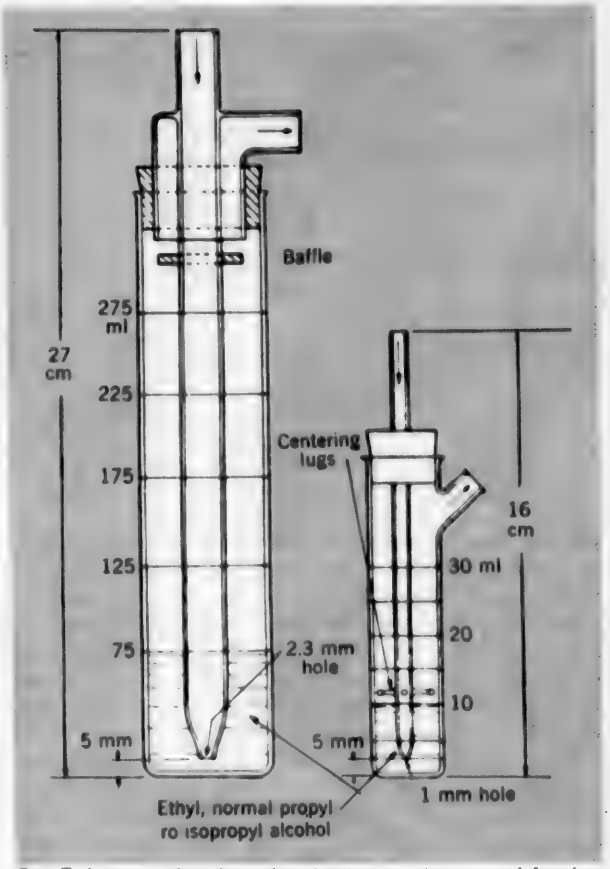


Fig. 7. Large and midget glass impinger units as used for dust and some gas sampling.

also has the advantage of being soluble in acetone and ketones and therefore permits ready solution of the sample for further analyses.

*Electrostatic precipitators.* A home-made or a commercial variety of electrostatic precipitator may be used. The type widely used for industrial air analysis in workrooms is a commercial unit, described elsewhere. It consists primarily of a glass tube or metal tube unit which permits direct collection or on an inserted foil, either transparent or opaque material. The volume of air collected is a function of the dimensions of equipment and satisfactory units have been made ranging from a few liters per minute up to several cubic feet per minute. The commercial unit operates at 3 cfm.

*Thermal precipitators.* These are used primarily for particle enumeration rather than quantitative weight assays and several types have been available for many years. Recently, attempts have been made to increase these in size utilizing the same principle for collection. The collection efficiency is on the order of 100% but the dust free space around the hot body is quite limited.

## Direct Reading Devices for Air Contaminants

In my opinion, this is one of the most important phases of this discussion since its application to problems in industrial hygiene and workroom surveys is perhaps the greatest. One of the great needs in industrial hygiene workroom appraisal is the availability of devices which will provide an answer as soon as possible. The value of

**TABLE 2—DIRECT CHEMICAL REACTION DEVICES FOR GASES OR VAPORS—IMPREGNATED GRANULES OR GELS**

| Contaminant | Reagent | Col r Range | Concentration Range, PPM | Interference | Reference and Remarks |
|---|---|---|---|---|---|
| Aromatic Hydrocarbons, $C_6H_6$, $C_6H_5CH_3$, $C_6H_4(CH_3)_2$ | Sulfuric acid and paraformaldehyde | Violet-black; stain length measured. | 0-100 Benzene<br>0-400 Toluene xylene | Thiophene | 1 |
| Carbon Monoxide, CO | Palladium sulfate and molybdenum | Yellowish green to dark green | 10 -10,000 | $H_2S$ and $PH_3$ None with guard gel in place. | 2a, 2b |
| Halogenated hydrocarbons | Activated carbon in copper gauze. | Green; flame tested. | 0.2-50 | None | 3. Requires special swinging unit. |
| Hydrogen cyanide, HCN | | Blue stain length measured. | 0-50 | None | 4 |
| Hydrogen sulfide $H_2S$ | Silver cyanide | White to black; stain length measured. | 0-50<br>0-400 | Mercaptans | 5. Two size tubes used in commercial unit. |
| Sulfur dioxide, $SO_2$ | Ammonium vanadate or iodine and organic dye. | Blue-yellow; stain length measured. Blue to white. | 0-50 | Hydrogen sulfide or iodine method | 6, 7 |

such an answer, in terms of prevention of further injury or ability to advise the management of their environmental status, cannot be over-emphasized. The trend in recent years fortunately has been towards development of more of these devices. Efforts in the writer's laboratory in recent years have been in this regard since it is our opinion that the most useful device in the field is the one which gives the answer on the spot.

Direct reading devices may be dependent upon either chemical or physical reactions and may be simple or fairly complex machines. In all cases they are dependent upon some primary calibration. Those which depend upon chemical reactions can be fairly well standardized and if the reagents are stable, will hold their calibration throughout their useful life. Physical instruments may need to be checked and the desirability of doing this will be discussed at some length. The chemical procedures which may be employed will depend upon whether the sampling is for gases or particulates.

### Direct Chemical Reaction Devices

The method of collecting the sample in these devices depends upon the particular contaminant. It can be stated with some assurance that the most desirable method for collecting gases and vapors is a solid adsorbent; impregnated papers or cellulose are secondary in this regard although they can give favorable and reproducible results.

Liquids which contain an equivalent amount of the reactant for the contaminant may also be employed. In these, air is aspirated through the liquid until a given amount of standard solution, with indicator, is neutralized (air titration) or they may be employed in the form of colorimetric reagents which develop colors matching a given standard or a series of standards (air colorimetry). The standards may be liquid or colored gelatin film encased in a plastic holder for comparative purposes.

The solid adsorbent, in the writer's opinion, takes first preference because it provides a mechanism of absorption which is the most efficient and most suited to obtaining consistent results. The absorbents are granular of either adsorbent gels such as activated alumina or silica gel or simply inert granules such as pumice or sand coated with the detecting materials. A number of such methods have been developed, several of which have appeared quite recently. Tables 2, 3 and 4 list these methods and their collecting agents. It will be noted that solid adsorbents, test paper and liquid methods are included in this table.

Since the tables are self explanatory, there is no need for further discussion. However, hydrogen cyanide and sulfur dioxide methods have only been introduced regen fluoride and chlorinated hydrocarbons. The reagents are under consideration and in the writer's laboratory, work has been done on adsorbent gel methods for hydrogen fluoried and chlorinated hydrocarbons. The reagent indicated for methyl bromide can also react with some chlorinated hydrocarbons. All of these methods have the advantage that they will give an answer on location. The advantage of the granule procedures, in most instances, has been that they can be made with an indefinite shelf life. Because of complications in obtaining this extended life, one company which has specialized in this field, has recently developed a technique of separating the gel components into two phases so that oxidation and reduction cannot take place in the reactant gel. Mixing is done before use, in the field if desired, and tubes prepared in this manner ordinarily have a life of two to three weeks. However, if organic reagents are involved, then such tubes would continually deteriorate. For this reason, placing the components in separate tubes from which they can be mixed as needed gives ideal results and as far as has been ascertained to date, almost indefinite shelf life.

The sensitivity of this group of devices is such that in all cases values considerably below the hygienic standard can be detected. The procedure for analysis depends upon the sensitivity of the reaction. In the case of gases such as carbon monoxide, which do not adsorb readily, a complete color change of the given length of impregnated absorbent in the path of the gas will result and the color change will be uniform throughout its length. In others, such as hydrogen sulfide and aromatic hydrocarbons, the method of measuring is the stain length; the length of the stain is directly proportional to the concentration. However, it should be pointed out that stain length is a function of absorption phenomena and will, in most instances, have a logarithmic decrement shape, that is, high sensitivity in the lower range and decreasing for higher concentrations. One other limitation of these tube reagent instruments which is important to bear in mind is their flow sensitivity. Most absorbent gels are flow sensitive. An exception is hydrogen sulfide which reacts so readily.

**TABLE 3—DIRECT CHEMICAL REACTION DEVICES FOR GASES OR VAPORS—TEST PAPERS**

| Contaminant | Test Paper | Reagent | Color Range | Concentration Range, PPM | Interference | Reference and Remarks |
|---|---|---|---|---|---|---|
| Ammonia, $NH_3$ | Whatman No. 1 | Phenolphthalein paper<br>Litmus paper (blue) | White to pink<br>Blue to red<br>Reaction is timed | 10 to 100<br>10 to 100 | Alkaline mists | 8 |
| Arsine, $AsH_3$ | S & S 598 | 5% HgCl<br>or 10% $AgNO_3$ | Light yellow to orange | 4 to 200 | $H_2S$ | 8, 9. Use lead acetate paper preceding test paper if $H_2S$ is present. $AgNO_3$ paper not as stable as HgCl but 20 times more sensitive |
| Carbon Dioxide, $CO_2$ | Whatman No. 1 | Sat'd. $Sr(OH)_2 8H_2O$ and 1% Phenolphathalein. Dilute to 90% before use. | Time noted to decolorize paper reagent from red to white. | 10,000 to 200,000 | Extremely high concentrations of other acid gases—very improbable. | 10 |
| Carbon Monoxide, CO | S & S 598 | 0.5% $PdCl_2$ Acetone | Shades of gray to black | 25 to 1000 | $H_2S$, $NH_3$, $H_2$ above 1%; ethylene above 1%; gasoline above 2.5% | 11. Ampoule method is preferable. |
| Chlorine, $Cl_2$ | S & S 598 | 5% KI 0.5% starch glycerin<br>Sulfurous acid | Brown to black | 0.25 to 12 | $Br_2$ | 12 |
| Hydrogen Cyanide, (a) | S & S 598 | 1% benzedine acetate and 3% copper acetate | Light blue to dark blue | 10 to 50 | $Cl_2$, $Br_2$, HCl | 13 |
| Hydrogen Cyanide (b) | Whatman No. 40 | 0.5% $HgCl_2$ and 0.25% methyl orange | Pink to red color reaction timed | 20 to 200 | Paper should be stored and protected from light. | 14 |
| Hydrogen Sulfide, $H_2S$ | Whatman No. 1 | 10 gms lead acetate, 90 ml $H_2O$ and 5 ml acetic acid plus 10 ml glycerol | Light tan to dark brown | 7 to 133 | Mercaptans which are equally as toxic | 15 |
| Mercury Vapor, Hg | Warren's Cumberland coated 70 pounds | S, S or Se | Yellow to black | 0.1 to 70 | None — pink color due to heat should not be used | 16, 17. Air to be heated before passing. Modified paper insensitive to temperatures from 65 to 200 deg C. |
| Methyl Bromide $CH_3Br$ | S & S 598 Y | 0.006% fluorescein 20% NaOH | Greenish yellow to strong pink | 0 to 150 | Some other brominated hydrocarbons | 18. Requires reaction tube (Hoolamite) preceding unit. Can be adapted to chlorinated hydrocarbons |
| Phosgene $COCl_2$ | Whatman No. 1 | Diphenylamine and p-dimethylamine benzaldehyde | Light yellow to orange | 1 to 100 | $Cl_2$ and HCl | 19. $Cl_2$ and HCl interference removed by drawing sample through pumice soaked with sodium thiosulfate and sodium iodide |
| Phosphine $PH_3$ | Whatman No. 1 | 1% $AgNO_3$ | Brown to black | 1 to 100 | Arsine, Stibine | 8, 9 |
| Stibine $SbH_3$ | Whatman No. 1 | 1% $AgNO_3$ | Brown to black | 1 to 100 | Phosphine, Arsine | 8, 9 |
| Sulfur Dioxide | S & S 598 | Starch KI $KIO_3$ glycerine | Light brown to black | 4 to 200 | Other oxidizing gases which reduce iodides | 20 |

Flow regulation is accomplished by means of an orifice valve control so that the sampling rate does not exceed 90 millimeters per minute. This is incorporated in the squeeze bulb apparatus shown in Fig. 7 and provides a very effective means of control. This same precaution should be mentioned with regard to test papers where they are used. Rapid aspiration through a test paper provides velocities too high for complete reactions to take place satisfactorily. In many instances it will be found that the stain at the rear of the paper is much darker than the front portion, indicating that reaction at the rear surface results because of the concentration gradient. This is one of the chief reasons why solid adsorbents are preferable to papers since they provide more collecting surface in depth.

Methods employing liquids in the field are usually not considered of the highest desirability by field personnel, inasmuch as they require more care in handling, are bulkier and create disposal problems in many instances. Self-contained tubes of gels can be returned to the laboratory for further reference if they are stable or may be disposed of immediately without any problem. Ordinarily, the solid adsorbent ranks first in minimal size, the test papers next, and the liquid systems last. One liquid system which is noted in the table is that for nitrogen dioxide which utilizes 50 milliliter glass syringes. These must be

**TABLE 4—DIRECT CHEMICAL REACTION DEVICES FOR GASES OR VAPORS—DIRECT INDICATING LIQUIDS**

| Contaminant | Absorber and Reagent | Color Range | Concentration Range, PPM | Interferences | Reference and Remarks |
|---|---|---|---|---|---|
| Ammonia, $NH_3$ | Simple bubbler in test tube; 0.0001 N sulfuric acid; methyl purple indicator. | Purple to green | 0—100 | Alkaline gases | 21. Uses compact syringe sampler 1 ml. std=0.0017 mgs ammonia |
| Aniline $C_6H_5NH_2$ | Simple test tube bubbler 1% HCl. Bleaching powder, ammonia, phenol solution. | Colorless to matching blue standards | 5—200 | None | 22. Toluidine. Blue for field standard |
| Benzene $C_6H_6$ | Simple test tube absorber 0.5 ml of 40% HCHO in 10 ml conc. $H_2SO_4$ | Straw to dark brown | <100—1500 | Toluene, xylene naphthalene and thiophene | 23. Sodium nitroprusside standard |
| Carbon dioxide, $CO_2$ | Grab sample flask 0.0001 N, NaOH and phenolphthalein | Red to pink | 10—300 Can be adapted to high concentrations | Acid gases | 24 |
| Carbon disulfide, $CS_2$ | Simple test tube absorber. Copper acetate, alcohol, diethylamine, triethanolamine. | Clear to yellow | 0.1—1400 | Hydrogen sulfide. Use lead acetate paper as filter | 25, 26. Standards made from $CS_2$ and reagent |
| Chlorine | Simple test tube absorber 0.1 gm. O-tolidine in 100 ml. conc. HCl made up to 1 liter with distilled water. | Clear to yellow | 1—63 | None | 27. Potassium dichromate permanent. Standard reagent stable 6 months |
| Hydrogen cyanide, HCN | Midget impinger tube with rubber aspirato bulb. Phenolphthalein, copper sulfate, Sodium phosphate buffer. | Clear to red | 0—300 | Chlorine, bromine, iodine, phenol | 28 |
| Nitrogen dioxide, $NO_2$ | Simple test tube absorber. Sulfanic acid and a-naphthylamine solutions or fritted absorber at 0.4 lpm and sulfanilic acid, N-(l-naphthyl)-ethylene diamine dihydroxychloride and acetic acid. | Clear to pink<br>Clear to red violet | 10—125<br>0.1—50 | Ozone, chlorine | 29, 30. Permanent color standards in field unit available from Mine Safety Appliances Co., Pittsburgh, Pa. |
| Sulfur dioxide, $SO_2$ | Midget impinger at 2.83 lpm (standard rate). 0.0025 N Iodine and 10% KI solution. | Blue to colorless | <1—100 | Hydrogen sulfide, nitrogen dioxide, and other oxidizing gases | 31 |

handled carefully as well as lubricated frequently in order to insure good operation.

### Direct Physical Methods for Gases and Vapors

Table 5 lists the physical methods of most importance for detecting gases and vapors. In this regard it may be stated that every known physical characteristic of gas-air mixtures has been used for gas analysis. However, in the industrial hygiene instrument field, the fact that we are dealing with such small concentrations means that some of the changes in physical characteristics are too small to be measured easily or accurately. The changes in gas density or gas viscosity which might be useful in the range of 1% gases or for combustion work are not of much value in hygienic assays. It is also apparent from this consideration that velocity of sound or microwave adsorption, which are other characteristics, are limited and adsorption techniques cannot go much below 0.04 or 0.05% even with the most sensitive devices which have been developed to date. The physical methods for gases and vapors are now discussed.

### Optical Methods

The optical methods that are useful are the interferometric, photometric and spectrum absorption principles, particularly in the ultra-violet or the infrared bands. One other spectrum which might be discussed briefly is the spectrum of a particular gas phase in the visible region such as the copper chloride spectrum used for the Halide meter method of measuring halogenated hydrocarbons.

*Interferometer.* This is a device for measuring gas concentrations and is very useful, although it is non-selective as indicated in Table 5. It is a precise optical instrument and not available generally in this country because of the precision in manufacture and the limted demand.

*Photometric.* Devices in this class are available in various types; some are smokemeters which have received attention recently and provide a method of measuring scattering by particles in the atmosphere. Ammonium chloride or sulfuric acid mist are examples that can be measured by this technique.

*Spectrum absorption.* By far, spectrum absorption principles have been the most widely used in gas analysis and hold the most promise for incorporation into direct field application instruments. The ultraviolet method, utilizing the 2537 Angstrom spectrum of mercury vapor has been applied for both mercury vapor detection and other gases as shown in Table 5. Infrared devices can be provided for all hetero-atomic gases having absorption bands in the infrared. Some of the limitations of the spectrum absorption devices, the infrared in particular, are the desirability of getting good sources of controlled band radiation and providing effective filters for limiting the band width. Interference from particulate matter is obtained by filters and interference from other gases is only possible where bands are similar.

### Heat of Combustion Instruments

These instruments have been widely applied, in particular not only for inflammable gas concentrations but also for low concentrations of combustible type vapors.

They are not specific but can be calibrated for a single vapor or known mixtures. Their general range of utility is indicated in Table 5.

### Thermal Conductivity Instruments

These instruments are, in general, limited to higher concentrations and form the basis for most of the less expensive gas detecting devices used for analyzing higher concentrations of carbon dioxide such as engine exhausts or oil burner flue gases.

Vapor pressure procedures are those which require a liquid condensing solution at low temperature and for that reason are not primarily adapted to field application.

**TABLE 5—PHYSICAL METHODS EMPLOYED IN AIR ANALYSIS**

| Method | Principle of Operation | Type of Sampling | Range | | Application and Remarks | Reference |
|---|---|---|---|---|---|---|
| | | | Lower ppm | Upper ppm | | |
| Absorption (volumetric, gasometric, or manometric) | Measured volume of gas-air mixture is absorbed by reagent and volume shrinkage determined. Pressure reduction may also be measured. (Manometric) | Grab | 300 | 1,000,000 | Selective. Oxygen deficiency determinator. High concentrations of gases. Special forms will detect lower concentrations. Principally a laboratory apparatus. U. S. Bureau of Mines describes a portable form for field use. | 1<br>2<br>3 |
| Adsorption (gravimetric) | Gas-air or vapor-air mixture is trapped on equilibrated adsorbent such as activated charcoal or silica gel. Change in weight represents weight of contaminant in known air volume. | Continuous | <1 | Depends on amount sampled | Non-selective. Used primarily for total solvents when a mixture of solvents is encountered. | 4<br>5 |
| Electrical conductivity | Gas-air mixture is absorbed in a solution whose electrical conductivity is measured before and after absorption. | Grab or continuous | 0.01 | 10,000 | Selective and can be applied to all acid or alkaline gases and also to vapors which can be burned to $CO_2$, $SO_2$ or HCl. Field instrument is available. | 6<br>7 |
| Heat of combustion—benzol indicator or Vapotester | 1. Gas-air or vapor mixture is passed over a heated (above gas combustion temperature) platinum wire which is part of a balanced electrical resistance bridge. The combustion of the gas on the wire unbalances the bridge. | Grab | 20 | 1,000 | Selective. Field instrument was designed primarily for benzol but can be applied to other combustible gases not removed by water vapor absorbent which is provided and necessary to the proper operation of the instrument. | 8<br>9 |
| Heat of combustion—explosimeter. (Flammable) | 2. Explosimeter is a less sensitive form of the above instrument for explosive concentrations of inflammable gases. | Grab | 10% of lower inflammable limit, 1% in most sensitive inst. | 50,000 | Water vapor absorbent not necessary because of lower sensitivity, instrument is used for explosive and inflammability determinations. Single meter calibrations for all gases for which the product of molecular heat of combination and the lower explosive limit is a constant. | 10 |
| Heat of combustion—CO indicator (Hopcalite) | 3. Gas is passed over a catalyst (Hopcalite) which converts CO to $CO_2$ and the heat of combustion is measured by a thermopile which is connected to a galvanometer. | Continuous | 10 | 10,000 | Used in the field (portable apparatus) and tunnels for CO determination. Water vapor and oil fumes can poison catalyst and are removed before passing over catalyst. | 11<br>12 |
| Interferometer | Refractivity of gas-air or vapor-air mixture as compared to dry air is measured by comparison of interference fringes or Fraunhofer lines when light is passed through gas-air mixture. | Grab | 12 to 127 | 100,000 to 1,000,000 | Non-selective. Sensitivity depends on refractivity of gas or vapor. $CO_2$ and moisture interfere and must be removed. Apparatus made in both portable and laboratory types. | 1<br>13<br>14<br>15 |
| Spectrum absorption—ultra-violet | Gas-air or vapor-air mixture is passed through a tube with an ultraviolet light source at one end and a photoelectric cell at the other. Gases or vapors which have absorption bands in the ultraviolet or near ultraviolet absorb light and diminish cell response which is registered by a calibrated meter. | Grab or continuous | 0.001 to 10 | 0.01 to 1 | Sensitive to several gases and vapors. Maximum sensitivity for mercury vapor. Water vapor and $CO_2$ do not interfere. Field instruments for mercury, trichloroethylene, perchlorethylene have been developed. By using mercuric oxide at controlled temperatures mercury vapor detectors of the spectrum absorption type can be used with gases such as carbon monoxide (18) ethylene (19) and can be used to detect vapors such as benzene, ethanol and others (20). | 16<br>17<br>18<br>19<br>20 |

**TABLE 5 (Continued)—PHYSICAL METHODS EMPLOYED IN AIR ANALYSIS**

| Method | Principle of Operation | Type of Sampling | Range | | Application and Remarks | Reference |
|---|---|---|---|---|---|---|
| | | | Lower ppm | Upper ppm | | |
| Spectrum absorption—Infrared | Gas-air or vapor-air mixture is passed through a tube with a source of infra-red (heated filament) at one end and a thermopile for recording absorption of infrared at the other end. Gases or vapors having absorption bands in infrared absorb the infra-red rays and diminish amount of heat reaching thermopile. This is registered by a calibrated galvanometer or ammeter. | Grab or continuous | 1 | 1,000,000 | Sensitive to all heteroatomic gases and vapors. Bands for absorption in infra-red vary with gases just as in ultra-violet bands. Thus the methods may be made selective by the development of screening filters. Field infrared unit is available for CO and $CO_2$. British manufacturer can supply instrument for any deteratomic gas specified. | 21 |
| Spectrum absorption—mass spectrum | Separates according to mass, gaseous ions formed in an evacuated system. Abundance of each ionic species is measured electrically by electrometer tube and amplifier. | Grab or continuous | 1 | 5,000 | Applicable to all gases and vapors but requires expensive and elaborate equipment only adapted for laboratory handling of samples collected on silica gel and revaporized or grab samples. | 22<br>23 |
| Thermal conductivity | Gas or vapor mixture is passed over a heated wire (below ignition temperature). Change in heat loss of wire to surrounding gas mixture is registered by change in wire resistance measured on a balanced Wheatstone bridge. | Grab or continuous | 25 | 10 | Non-selective. Water vapor and carbon dioxide interfere and must be removed. Greatest application in field is to high concentrations such as in flue gas analyzers. | 1<br>12<br>24<br>25 |
| Vapor pressure | Gas or vapor-air mixture is passed over a cooled condensing surface in a confined chamber. The chamber is then evacuated and the condensed gas allowed to evaporate and its pressure measured. Ice-water, dry ice-acetone or liquid air mixtures may be used depending upon contaminant sampled. | Grab or continuous | 10 | 1 | Selective. Only high concentrations, 1,000 ppm or greater, can be obtained by grab samples. Applicable in field only to vapors or gases for which ice-water or dry ice-acetone mixtures can be used since liquid air is too difficult to obtain and handle. Contaminants must be miscible with water. Sensitivity depends on contaminant sampled and amount of air sampled in continuous method. | 26<br>27<br>28<br>29 |

In all cases, they are considered as continuous flow devices. The condensation of gases at low temperatures may be applied to other physical instruments to increase their sensitivity.

### Absorption

Absorption methods are useful only in the higher concentration range but a number of compact devices of this type will indicate oxygen deficiencies or $CO_2$ concentrations. Since hygienic limits of $CO_2$ are fairly high, it is possible to use this principle to measure those contaminants whose concentrations might be in the hygienic range.

### Miscellaneous

There are a number of miscellaneous devices used for analyzing oxygen or gases depending upon a paramagnetic principle such as the Pauling gas analyzer or the mass spectrometer which depends upon differential mass characteristics. Only the oxygen analyzer is portable enough for field work, and is useful for detecting atmospheres deficient in oxygen.

In the discussion of physical devices for gas analysis, it is important to bear in mind that all of these devices are dependent for reliability on their basic calibration. Such calibrations are important in assessing the instrument range as well as its sensitivity and can be done with static or dynamic methods which are beyond the scope of this article. It is important to note that physical instruments which employ vacuum tubes or resistance wires may change their calibration due to aging of these components. Thus, it is essential that frequent recalibration be performed. It is also important to point out from the structural standpoint, that damage from vibration and impact from poor handling is a factor which can influence the calibration of these devices. In practical use it is essential that recalibration be done at frequent intervals in order that reliability be obtained since handling and other use conditions can alter response of many components.

### Direct Chemical Reaction Devices for Particulates

This group of procedures, shown in Table 6, employs the fact that the deposited particulates, collected by filtration procedures, can be treated in order to give a color or reaction. They can utilize either hand pumps or continuous sampling holders. In some instances they may give

**TABLE 6—DIRECT CHEMICAL REACTION DEVICES FOR PARTICULATES**

| Contaminant | Reagents | Color Range | Concentration Range, mgs/cu m | Interferences | References or Remarks |
|---|---|---|---|---|---|
| Atmospheric dust | None—White filter paper various grades. Whatman No. 41 and 4. Millipore (MF) HA or AA. | White to black | 0.01—10.0 | Any other particulates. | 1, 2, 3. Dust collected on MF can be counted directly. |
| Carbon smoke | None—White filter paper. | Gray to black | 0.1—10.0 | Any other particulates. | Commercial instruments available from Bachrach Inst. Co., Pittsburgh, Pa., and F. W. Dwyer Co., Chicago, Ill. |
| Coal dust | None—White filter paper. | White to black | <0.1—1.0 | Other particulates. | 4 |
| Chromic acid mist | (E & D 623-26) S-diphenylcarbazide phthallic anhydride glycerol. | Pink to purple | <1.0—50 | None | 5 |
| Lead dust or fume | Confined spot test paper S & S 598Y. Tetrahydroxyquinone and buffer. | Yellow to purple | <0.1—10 | None | 6 |
| Sulfur | No. 1 Whatman filter paper. Thallous acetate and hydrogen sulfide. | White to red brown | 0.1—5.0 | Selenium | 7 |
| Sulfuric acid | Specially washed filter paper. | None | 0.01—5.0 | Paper 90% efficient. Other acid mists analyzed by electrometric titration. | 8 |
| Welding fumes | None—White filter paper. (E & D 613-21) | Faint brown to dark brown | <5—150 | Zinc fumes, if present, lower readings. | 9 |
| Zinc oxide | Black filter paper. Paper dyed with nigrosine black or obtained commercially. | Faint gray to white | <10—50 | Other metal fumes which alter white color. | 10 |

a direct reading such as in the case of smokes or atmospheric dusts. The question of interpretation of this reading is fairly simple since a smoke scale or an intensity reading on a light penetrometer permits interpretation of the results. In some cases the paper may be impregnated with a reactant where the atmospheric contaminant is in liquid state such as a mist which reacts directly with the impregnated paper reagents. The chromic acid mist detector developed in our laboratory several years ago is a good example.

Welding fume, in particular, can be measured directly by the brownish color of the welding fume on white filter paper bearing in mind that there is some effect of various alloys on this stain. For example, welding on black iron gives stains which are more intense than when welding with coated rods on galvanized iron. These can be calibrated with enough sensitivity for field investigations.

The most recent adaption in this area is a new method for determining lead fume and fine lead dust in air. This procedure is also listed in Table 6. It has been found sensitive enough to measure lead concentration with fair accuracy near the present hygienic standard levels and the procedure is subject to minimal interference. It is hoped that other procedures of this type will become available. Several years ago the writer developed a procedure for zinc oxide fume in air using a black filter paper and measuring the white stain of the zinc oxide on the black background. Such standards can be readily developed and found to be sufficiently sensitive in the range of concentrations below those which produce metal fume fever.

## Direct Physical Methods for Particulates

In this aspect there are devices which have been used for many years for indicating light absorption or light scattering by particulate contaminants in air. This has always been a very attractive method of physicists because it is so obvious and for this reason several tyndallometric devices have been developed. It should be pointed out though, that because light scattering is highly susceptible to changes in particle size, most of these methods cannot be applied except when known sizes and size distributions are present since slight changes in size distribution can cause alterations in calibration even though changes in mean particle size are not apparent.

A number of direct counting devices have been used for dust work. These are indicated as devices which impinge the dust upon a glass slide where it may be counted microscopically. The various konimeters, the Owens, the Bausch & Lomb and several other devices fall in this category. The thermal precipitator can provide a dust deposit on a slide which can be measured directly in the field if desired and may also be included in this group. Any of the dust sampling units using glass slides, such as impactors, can be utilized if a portable microscope is provided with the apparatus.

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# Radiant Heating for Outdoor Applications

**Outdoor heating units, served by gas or electricity, are used in a number of European installations to make shopping more pleasant in winter. This and space heating by high temperature air are discussed in this month's letter from our correspondent abroad.**

A PROPHET is not without honor, save in his own country. In consequence, prophets do not get elected to local civic offices. And for those who do, the exact opposite holds. They are honored in their own homes, and perhaps completely unknown elsewhere. Therefore it is no disrespect to the worthy gentleman of Brussels who occupy the foreground of the photograph to explain that the object of interest to us is the queer thing like a lamp standard behind them. These outdoor radiant heaters were placed about every 10 yards along three miles of sidewalk in the main shopping streets.

They are not a permanent installation, but were part of the fair which is held every winter in Brussels, and which is organized by an association of store owners.

### Choice of Fuel and Wave-Length

This particular installation was supplied with bottled gas, thus making each unit independent of service piping. It was, in fact, an advertisement for the firm which supplies bottled fuel gas, apart from its purpose in making mid-winter shopping more pleasant for the inhabitants of Brussels. Not more than an inch of snow fell during the period of operation of these heaters, so that their performance for snow melting cannot be assessed.

Following the German lead, several European countries have now experimented with outdoor radiant heating.

Outdoor radiant heating installation showing the special units. Photo courtesy Le Soir, Brussels.

The town of Lille in France installed gas heaters in the main shopping street some 13 ft above the sidewalk and 15 to 20 ft apart. The consumption of each heater was about 50 cu ft per hour. In this case, ordinary town gas was used, the service pipes being out in the open, but neatly arranged. No prolonged period of testing was possible with this installation either, since it was dismantled after a month. Paris has experienced electric heating (store fronts in the Boulevard Haussmann). At first sight this seems a wild extravagance. But heating by electricity is not necessarily more expensive than by other methods when intermittent heating only is required, or when only localized heat is needed in a large space.

The electrical installation is particularly simple. In appearance the heaters are not unlike fluorescent lighting tubes. A fused silica tube has an alloy resistance wire wound on to it, and a polished metal reflector above the heating element reflects downwards the heat emitted by the back of the tube. Such heaters are being installed in theatres, elevator halls, and other large areas frequented by the public.

Electric heating gives greater freedom than does gas in the choice of operating temperature. In the French report on the foregoing in a recent issue of *Techniques et informations du Chauffage et de la Plomberie* there is some consideration of the ideal temperature of the emitting surface for radiant heating duties. The following figures are given, indicating the temperatures which result in maximum radiation of the wave-lengths stated.

| | |
|---|---|
| 1 micron ..... | 2,615C (4740F) |
| 2 microns ..... | 1,167C (2130F) |
| 3 microns ..... | 607C (1125F) |
| 4 microns ..... | 447C ( 840F) |
| 5 microns ..... | 300C ( 572F) |
| 6 microns ..... | 207C ( 405F) |
| 7 microns ..... | 137C ( 279F) |
| 8 microns ..... | 87C ( 188F) |
| 9 microns ..... | 47C ( 117F) |
| 10 microns ..... | 15C ( 59F) |

This is followed by the statement that "for human beings, infra-red radiation of a wave-length near to 2 or 3 microns is the most efficacious and the most agreeable. That is why a wood fire, of which the burning embers radiate in the 3 micron region, is so much appreciated, and why on the contrary central heating by radiators at a temperature of 170 to 180F, which emit infra-red rays of about 8 microns, produces a disagreeable sensation of dryness, particularly on the mucous membranes." (So much for panel heating, and hurrah for the open fire!).

It is not stated who "recognizes" this. But it is a very convenient argument in favor of small, high temperature sources of radiation. It would obviously be very costly to install large overhead structures. One might just as well go a bit further and roof the whole area so that no snow falls on the ground.

Accepting for the moment, however, that overhead heating by small sources at intervals is (as has now been proved) a satisfactory and fairly cheap method of keeping people warm and dry-shod, whether they are looking into store display windows or waiting in theatre queues, let us consider some drawbacks. Obviously electric heating needs careful weather protection; one does not like the thought of electric heating elements exposed to driving rain; even with the lowest practicable voltage there will be problems of corrosion. The Paris installation is not truly out-of-doors, because it is in a covered walkway.

The great trouble with gas is flame stability in a high wind. Last September in this *Letter* reference was made to experiments in Britain which were to be made with a boosted air supply. At the cost and nuisance of a fan and piping for air, one can achieve stable combustion under all conditions. If nothing more is heard of this in Britain, it will not be because the idea in some way does not work, or would not be economic. It will just be that we have not really enough gas to spare to allow it to be used for a luxury purpose.

What a neat solution it would be if some of the very difficult atomic reaction wastes could be used for this purpose! There are some products which are intensely active for several months or a few years. Their radiation has a wave-length that is very much too short, and which is positively dangerous. But supposing a capsule of such material could be surrounded by layers of other elements which would totally absorb this radiation and re-radiate the energy in the wave-length required, city sidewalks could become pleasant areas in the worst of weathers.

### Space Heating with High Temperature Air

Another report from France concerns a way in which temperatures higher than those previously employed have been successfully used in warm air heating of a factory. It is suggested that the same principles could also be used for both heating and air conditioning in houses. The report is by Charles Boileau in *Chauffage—Ventilation—Conditionnement* (**32**, 5, 2), and the main example given is a textile factory in Spain near Madrid. Madrid is in the same latitude as Pittsburgh, but the general level of the land is higher, being at an altitude of 2,000 to 2,500 ft and the summer climate is both hot and dry. This is unsuitable for textile work, and humidities of 65 to 75% R.H. were specified for various parts of the factory. Temperature to be maintained at at least 68 deg in winter and not to exceed 77 deg in summer.

Heating in winter is achieved by warming fresh filtered air to 340 deg. This is humidified to the required extent by adding cold water, the evaporation of which brings down the temperature to 300 deg, at which condition it is piped into the factory building. A small steam boiler, which is used in summer for humidification, can be brought into use also in the winter so that on the coldest days the full temperature of 340 deg is available in the air for heating. Inside the building, this hot air is distributed between a number of overhead radiant panels, and in this way some 75% of the heat in it is made available in the form of radiation. The ducts which form these panels are cheaply made out of meter-wide mild steel sheeting, covered with a layer of glass wool insulation to reduce the loss of heat in an upward direction towards the roof. There is no need to be fussy in the tightness of these structures, because the differential pressures are negligible and it does not matter if they do leak a little bit. However, the air cools as it travels along, so the panels need careful balancing in a large shop since otherwise the entry end would be warmer than the other. They also need care in installation to allow for the expansion under the temperature conditions.

When the air has given up sufficient heat, it is allowed to enter the heated space as ventilating air. There are no return air ducts, and no recirculation of any air. The rate of air change is made just sufficient for comfort, and with the air being heated to such a high temperature to start with the quantity needing to be supplied is far less than with ordinary warm-air systems. The air-supply fan and all the duct work are both small and cheap. If it is economic to do so, the main distributing ducts can be reduced in size still further by using a higher pressure fan and high velocity in the ducts.

The author points out that this system can be regarded as intermediate between ordinary warm-air systems and heating by air or water or steam in a closed circuit with radiators or heating panels. Those warm-air systems in which the air is taken through underfloor ducts before entering the heated space provide a third to a half of the heat by radiation or convection to the air of the room, the balance being in the ventilating air. A closed circuit system provides 100% by radiation or convection, and none in the ventilating air unless this is separately tempered or is warmed at the point of injection. The new system supplies 70 to 80% by radiation and the balance in the ventilating air.

### Application for Apartments

For application to houses and blocks of apartments, the author thinks the system is particularly suited on account of the very small size, as well as the cheapness, of the ducting, although it does not appear that there is yet any actual installation. Design studies have been made, and it is proposed that within the rooms the heating elements should take the form of flat ducts in sheet metal placed diagonally in the angle between ceiling and wall and going round the room. The ducts would be completely embedded in plaster, and with an air supply temperature of 300 deg the surface temperature of the plaster would not exceed 206 deg, which is considered acceptable. After encircling the room in this way the air would enter it through a grille.

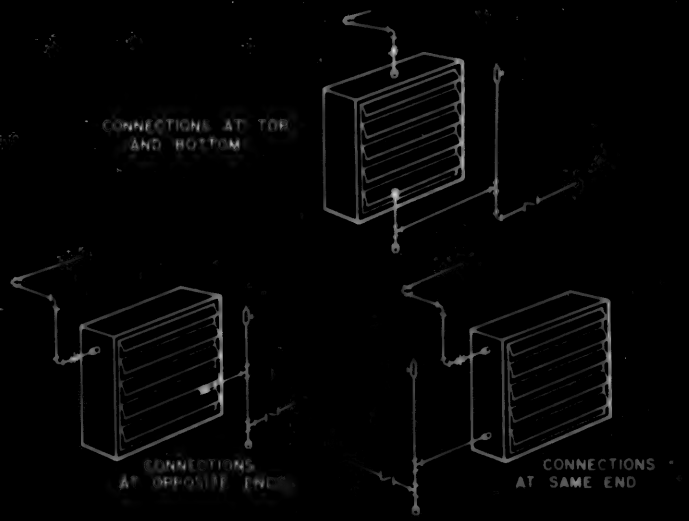
The same apparatus would be used for summer cooling. With the conditions in the room being maintained at 77 deg and 50% R.H., the dewpoint is 57.5 deg, so that moisture would form on any surface below this temperature. But if the air is chilled to 50 deg before distribution, the surface temperature of the plaster would not be below 60 deg under the conditions supposed, so that there would be no condensation.



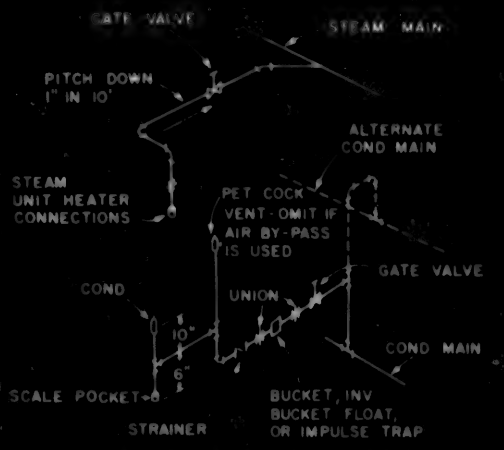
UNIT HEATER PIPING CONNECTIONS

# UNIT HEATER PIPING CONNECTIONS

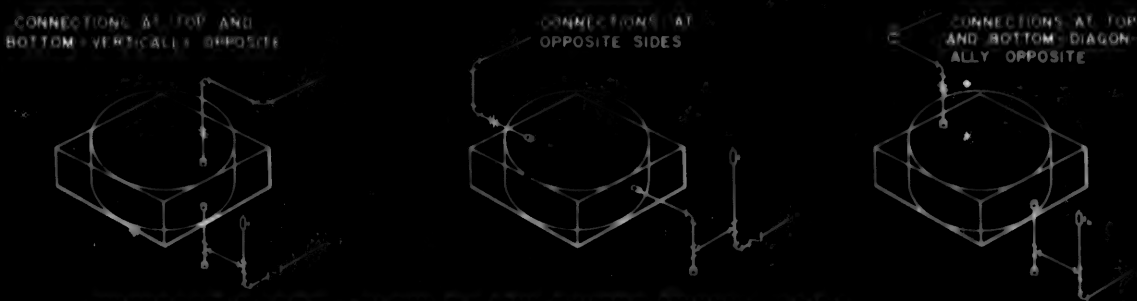
## STEAM SUPPLY—MEDIUM AND HIGH PRESSURE—ABOVE 15 PSIG
## CONDENSATE—RETURN TO OPEN RECEIVER OR FEED WATER HEATER



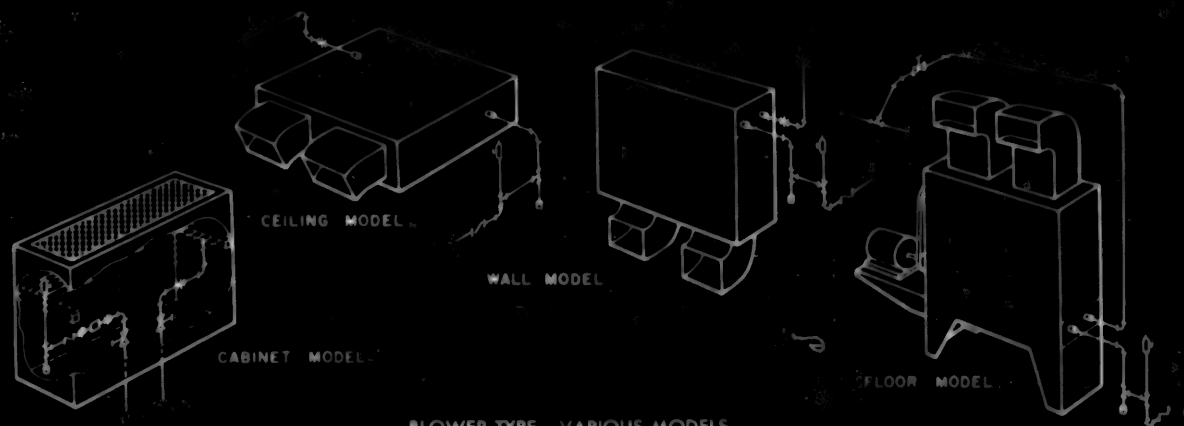

PROPELLER TYPE - HORIZONTAL DISCHARGE




TYPICAL PIPING AND SPECIALTIES FOR ALL MODELS AND TYPES
LOCATIONS OF STEAM AND CONDENSATE CONNECTIONS VARY


CONNECTIONS AT TOP AND BOTTOM - VERTICALLY OPPOSITE
CONNECTIONS AT OPPOSITE SIDES
CONNECTIONS AT TOP AND BOTTOM - DIAGONALLY OPPOSITE

PROPELLER TYPE - CIRCULAR AND SQUARE MODELS - VERTICAL DISCHARGE
VARIOUS LOCATIONS OF CONNECTIONS



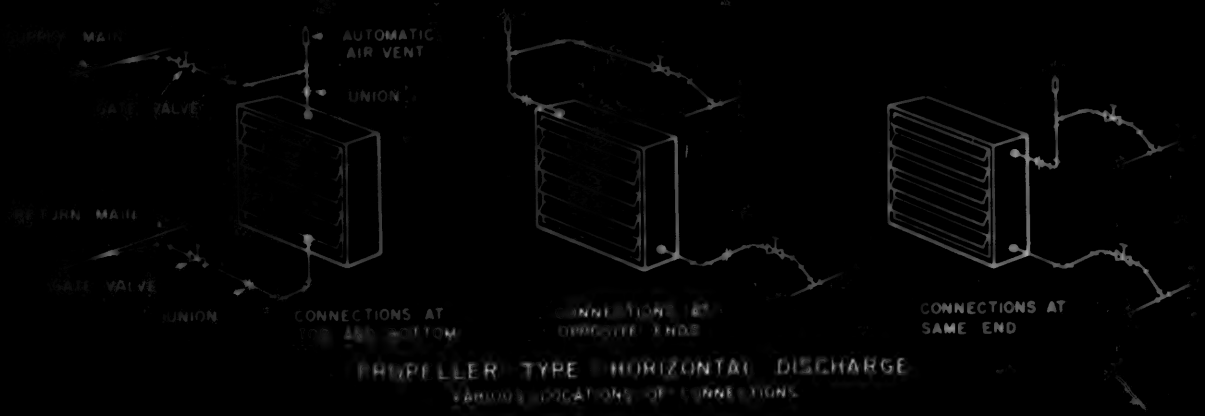

BLOWER TYPE - VARIOUS MODELS
VARIOUS LOCATIONS OF CONNECTIONS

LOCATIONS OF CONNECTIONS VARY WITH MANUFACTURERS' STANDARDS

CUT ALONG THIS LINE

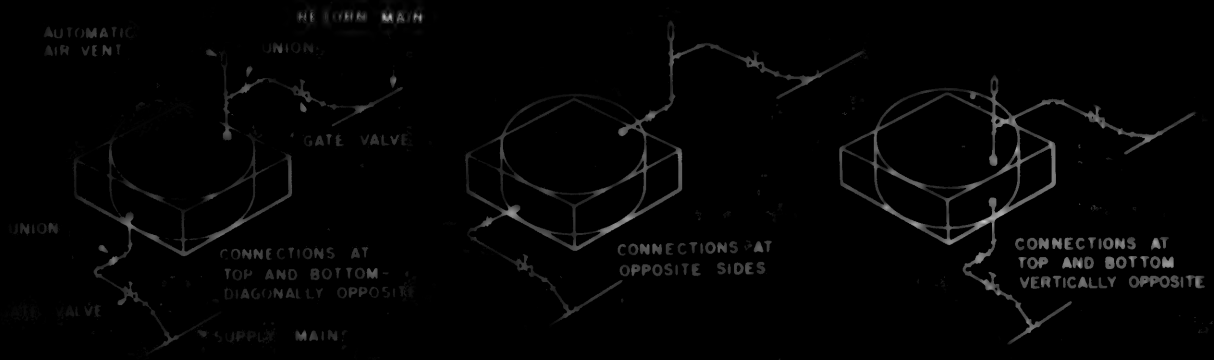
# UNIT HEATER PIPING CONNECTIONS

## HOT WATER SUPPLY—FORCED CIRCULATION



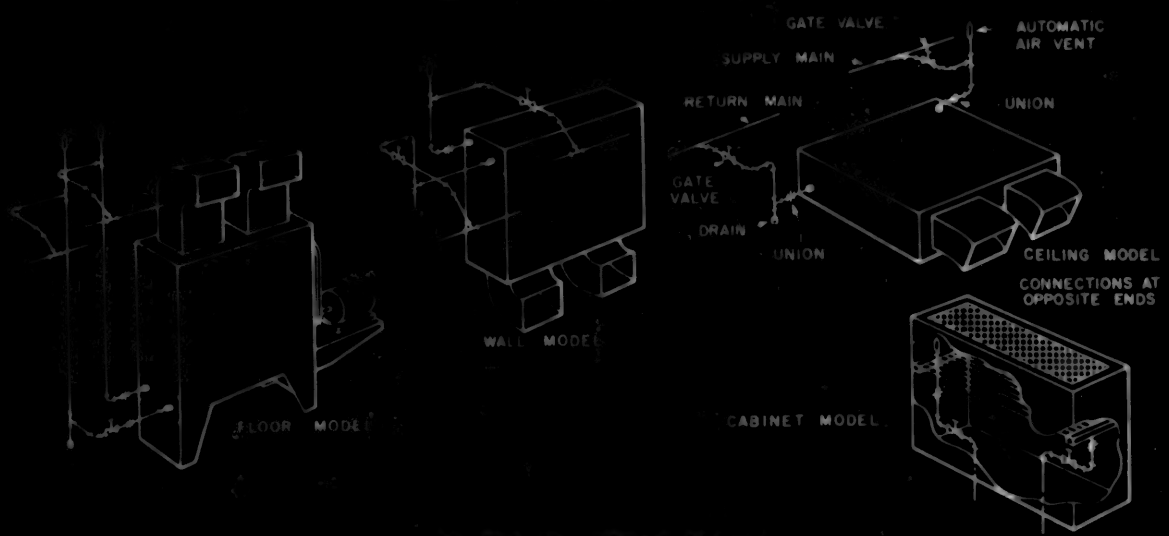

PROPELLER TYPE - HORIZONTAL DISCHARGE

VARIOUS LOCATIONS OF CONNECTIONS




PROPELLER TYPE - CIRCULAR AND SQUARE MODELS - VERTICAL DISCHARGE

VARIOUS LOCATIONS OF CONNECTIONS




BLOWER TYPE - VARIOUS MODELS

VARIOUS LOCATIONS OF CONNECTIONS

COURTESY OF THE INDUSTRIAL UNIT HEATER ASSOCIATION

# Chilled Water System Serves Offices of New Industrial Plant

L. F. GAFFNEY

Mechanical Engineer, Plant Engineering, Western Electric Co., Inc., New York, N. Y.

**Use of double glazing and shade screens, together with a central chilled water system gives Western Electric's new plant at Winston-Salem, N. C., an economical and flexible air conditioning system. Refrigeration plant for the building is located in a separate structure which also houses the boiler plant and process air compressors.**

AN economical and flexible air conditioning system with interesting features was installed in a new plant opened by the Western Electric Company at Winston-Salem, N. C., for the production of communication devices for the Bell Telephone system and the Armed Forces.

Essentially the plant consists of a one-story manufacturing building and partial basement, and a two-story office building with an additional lower floor below grade. There is a separate boiler house and service building.

The office building, of reinforced concrete construction with concrete block and face brick walls, was developed around a 7-foot module, with columns on 21 ft centers. It is entirely summer air conditioned except for service areas such as, toilet and locker rooms, and equipment room. These unconditioned areas are located along the back or west wall of the building. The chilled water supply for this building also serves the air conditioning units for the manufacturing building cafeteria, recreational area, and shop offices. All office building windows are fixed sash of sealed Thermopane in aluminum frames, and the manufacturing building has standard industrial type sash. The windows are also equipped with a louvered aluminum screening to further reduce solar heat load and glare.

## Layout Aids Air Distribution Zoning

Each floor of the 445 ft long by 100 ft wide building is divided into two halves—north and south, with an equipment room centered along the back wall of each half for the air handling units serving the particular area. Each air conditioning equipment room on the main and second floors has one multi-zone unit, one single zone unit and a return air fan.

Private offices and conference rooms, along the north, east and south exterior walls on the main and second floor, are served by the multi-zone units. These multi-zone air handling units were installed with dampers in the hot and cold air discharge plenums to deliver air at a final temperature to satisfy varying load requirements in the zones. Private offices with the same exposure, along the east wall for example, are grouped on the same supply air branch duct for one zone and are controlled, not individually, but as a single large area by a remote thermostat which senses average conditions within the zone. This thermostat is located in the return air duct.

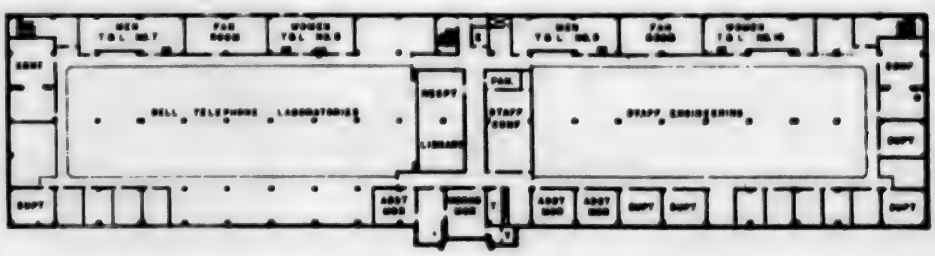
Private offices having two exposures at each corner of the building, included in the same zone as adjacent private offices having only one exposure, are equipped with thermostatically-controlled volume dampers. Conference rooms, because of rapid changes in occupancy, are treated as separate zones and are controlled by their own thermostats.

## Wall Radiation Is not Used

In this milder climate, installation of the double glass in a fixed sash eliminated the need for wall radiation during the winter cycle in the private offices and conference rooms. However, a small number of hot water convectors are installed along the back wall in the non-conditioned toilet and locker rooms and in the stairwells to take care of heat loss through the standard sash in those areas. The louvered screening added to all sash reduces the solar heat load during the summer cycle, and thereby reduces substantially the amount of refrigeration required to cool the building.

The central sections of both the main and second floors are divided into two unpartitioned general office areas, approximately 200 ft long and 65 ft wide. Single-zone air handling units satisfy the relatively uniform load requirements of lighting, occupancy and ventilation in these interior general office areas.

On the lower floor, three of the four air handling units installed are single zone type because no peripheral zoning is required due to negligible heat gain or heat loss through exterior walls below grade. The fourth unit is a multi-zone



Floor plan of second floor of the air conditioned office building.

**L. F. Gaffney, born in Cleveland, Ohio, studied pre-engineering at John Carroll University, Cleveland. In 1951 he graduated from the School of Architecture and Engineering, Catholic University of America, Washington, D. C. He is continuing his engineering studies at Brooklyn Polytechnic Institute. He was employed by John Paul Jones, Cary & Miller, consulting engineers, Cleveland and he worked in both the Washington, D. C., and New York offices of Edward E. Ashley, consulting engineer. From 1952 to the present, he has been associated with Western Electric Co., Inc., New York, in plant engineering. He served with the U. S. Army Ordnance in the European Theater from March, 1943 to November, 1945.**

unit serving two areas of radically different occupancy—a large tabulating room with machines dissipating a relatively high amount of heat and a record storage room with practically no load.

Five multi-zone units in all, with capacities ranging from 6250 to 15,700 cfm, and seven single zone units, capacity of 5250 to 16,900 cfm, are installed in the office building for a total of 12 supply units handling 136,000 cfm of air. A common return fan in each equipment room insures a positive amount of return air, 60 to 75%, depending on ventilation requirements for each system, to each supply unit during normal heating and cooling cycles.

Main floor of boiler room—refrigeration machines at left, boilers at right. Pumps and auxiliary equipment are installed in basement directly below.

Outside air, taken in through louvers in the back wall of the equipment rooms, make up the balance of design air quantities.

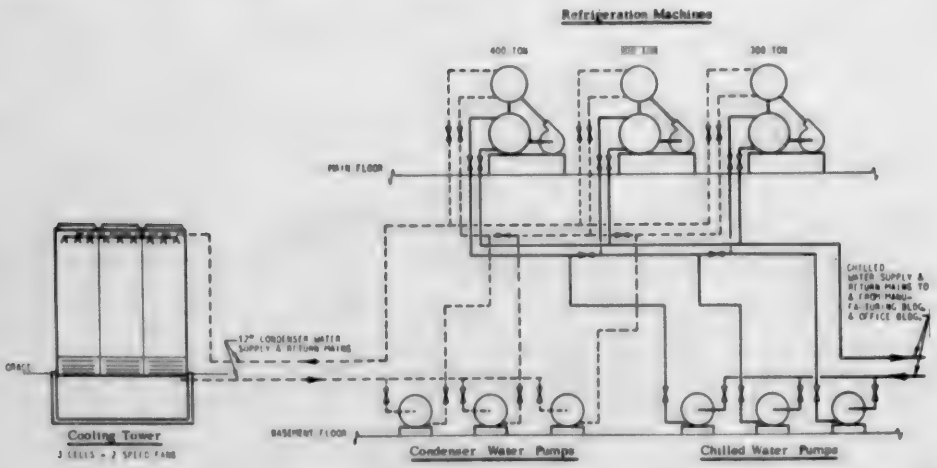
During intermediate operation, when 100% non-conditioned outside air can be utilized to satisfy comfort requirements inside the building, the return air is exhausted to the outside through an automatic damper control. The remaining 25 to 40% of the air supplied to an area is relieved through toilet room ventilation and smoke exhaust systems.

Chilled water and steam supply for all air conditioning units are piped from the boiler house through the manufacturing building to the point of entry into the office building, a distance of nearly 1000 ft. Steam supply is reduced from 90 psig to 5 psig after entering the office building. A chilled water loop was also installed in the manufacturing building to comfort cool the cafeteria and shop offices within that building.

The refrigeration plant for both the office and the manufacturing building air conditioning systems is located in a separate building which also houses the boiler plant and process air compressors. The refrigeration plant consists of three individual systems, called systems 1, 2 and 3—each with a centrifugal compressor, one chilled water pump, one condenser water pump and connecting piping. These three individual systems are headered together on a common supply and return mains extended through a tunnel to the manufacturing building to serve the air conditioned areas.

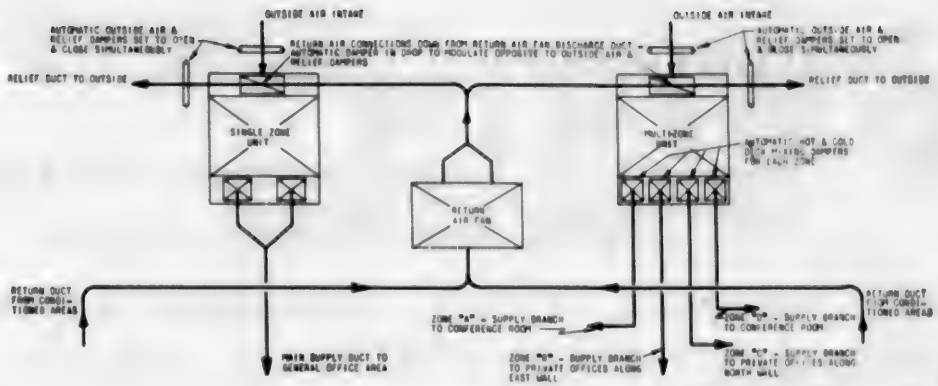
## Refrigeration Plant Has Flexible Operation

Compressors for systems 1, 2 and 3, namely two compressors at 300 tons capacity and one at 400 tons capacity, are mounted on the main floor of the boiler room. The auxiliary chilled water and condenser water pumps are located on the lower floor of the same building. The three refrigeration systems are interconnected with valved connections so that normal operation allows for use of any one or all of the three systems without manipulation of any valves. However, in the case of emergency operation, due to failure of a refrigeration compressor or its auxiliary pumps, any combination of the component pieces of equipment of these systems can be attained by manually opening or closing of certain required valves. For example, chilled water pump No. 1 of system 1 could be




Piping arrangement for refrigeration plant.

Typical arrangement of air handling units and return fans in air conditioning rooms.

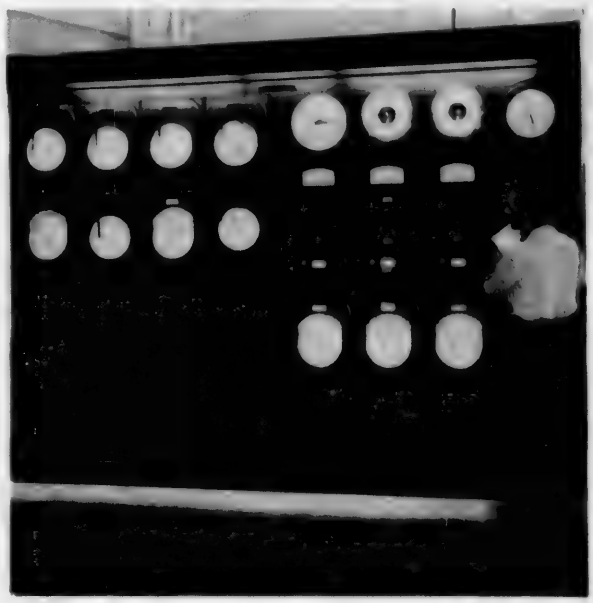

OUTSIDE AIR INTAKE
AUTOMATIC OUTSIDE AIR & RELIEF DAMPERS SET TO OPEN & CLOSE SIMULTANEOUSLY
RETURN AIR CONNECTIONS DOWN FROM RETURN AIR FAN DISCHARGE DUCT
AUTOMATIC DAMPER IN DROP TO MODULATE OPPOSITE TO OUTSIDE AIR & RELIEF DAMPERS
RELIEF DUCT TO OUTSIDE
SINGLE ZONE UNIT
MULTI-ZONE UNIT
AUTOMATIC HOT & COLD DECK MIXING DAMPERS FOR EACH ZONE
RETURN AIR FAN
RETURN DUCT FROM CONDITIONED AREAS
MAIN SUPPLY DUCT TO GENERAL OFFICE AREA
ZONE "A" - SUPPLY BRANCH TO CONFERENCE ROOM
ZONE "B" - SUPPLY BRANCH TO PRIVATE OFFICES ALONG EAST WALL
ZONE "C" - SUPPLY BRANCH TO CONFERENCE ROOM
ZONE "D" - SUPPLY BRANCH TO PRIVATE OFFICES ALONG NORTH WALL

made to serve compressor No. 2 of system 2. Or condenser pump No. 2 could operate in conjunction with compressor No. 3.

Systems 1, 2 and 3 are put into operation by starting the required chilled water and condenser water pumps for each system at the pushbutton stations provided for each pump on the boiler room instrument panelboard, located on the main floor, and then pressing the "start" buttons for the compressors at each compressor. One, two or all three systems may be manually put into operation in any desired sequence depending on the air conditioning load requirements and also on the accumulated running time of each compressor. The latter consideration insures equal wear for a season's operation. Indicating lights on the control panel show which compressors and auxiliaries are running.

A three-celled cooling tower was erected adjacent to the boiler house to serve the air conditioning refrigeration plant, process air compressors and manufacturing process cooling water requirements. In view of the fact that the cooling tower serves these three unrelated cooling water requirements, the operation of the tower is separate from the individual systems' requirements and is controlled automatically to supply the required amounts of cooling water at a fixed temperature of 85 deg F to serve whatever systems are in operation and demand cooling water. This automatic capacity control of the cooling tower is accomplished by the action of a thermostatic bulb placed in the leaving water main from the tower basin. This bulb senses the temperature of the cooling water and pneumatically actuates a program controller which automatically turns on or off the two-speed tower fans for each cell in the sequence based on the number of fans required to take care of the cooling water demands.

Refrigeration machines, 400-ton unit at extreme right, other two units are 300-ton capacity types.



Control board for the system.

The cooling tower is put into operation by pressing the "start" pushbuttons located on the boiler room instrument panelboard for each tower cell fan, which puts the fans under call of the program controller. A manual selector switch on the same panel is also used to select whatever sequence of fan operation is desired to maintain equal running time of the fans to avoid excessive wear. Indicating lights on the control panel show which fans are running.

*Air Conditioning and Refrigeration Equipment*

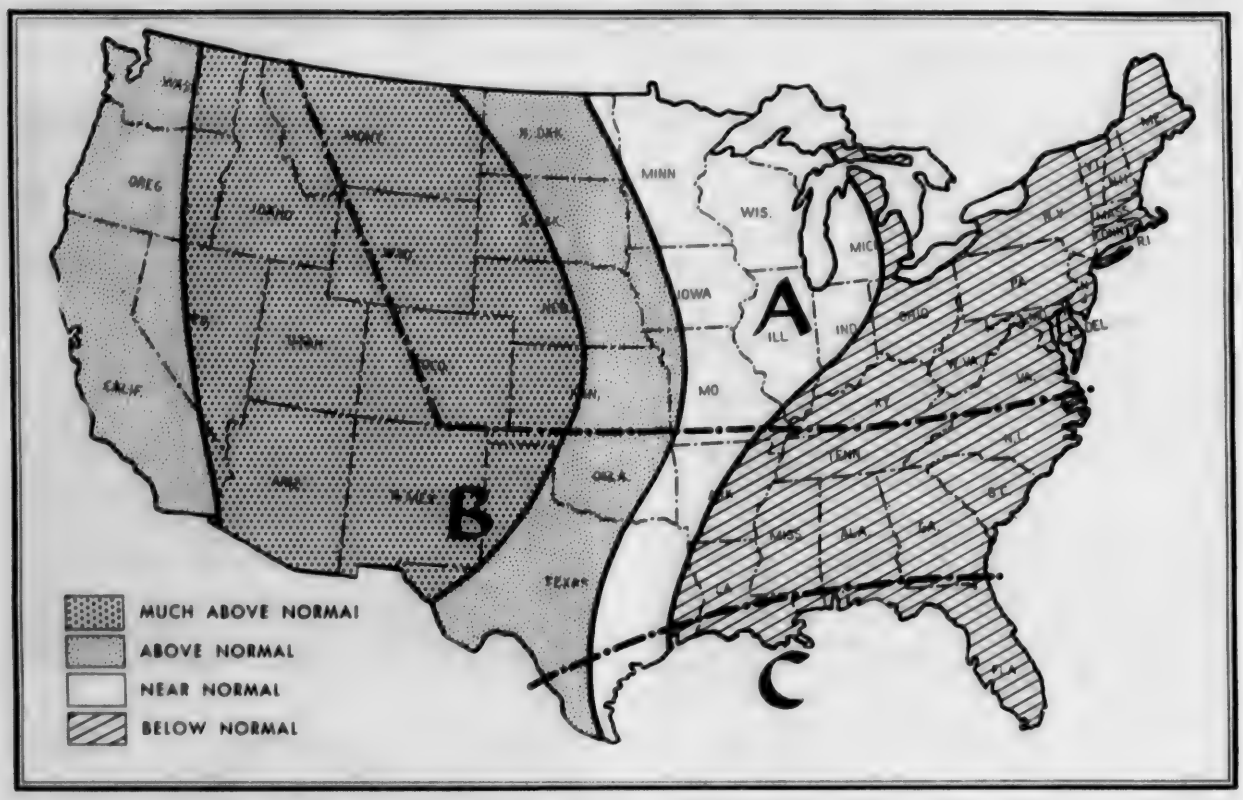
The following list gives the principal air conditioning and refrigeration equipment installed. This list does not indicate a preference by the Western Electric Co., Inc., for the product of any single manufacturer.

Air handling units ..... Trane Company, and American Blower Corp.
Return air fans ..... Carrier Corp.
Exhaust fans ..... Davidson Company
Ceiling diffusers ..... Connor Engineering Corp.
Refrigeration compressors ..... York Corp.
Cooling tower ..... Lillie-Hoffman, Inc.
Chilled and condenser water pumps . Buffalo Pumps, Inc.
Controls ..... Johnson Service Company

# Temperature Forecast for August

**Prepared for Air Conditioning, Heating and Ventilating**

**by Long Range Weather Consultants**




**KEY BY REGIONS**

| | A | B | C |
|---|---|---|---|
| MUCH ABOVE NORMAL | +4° or more | +4° or more | +3° or more |
| ABOVE NORMAL | +2° to +3° | +2° to +3° | +1° to +2° |
| NEAR NORMAL | +1° to −1° | +1° to −1° | 0° |
| BELOW NORMAL | −2° to −3° | −2° to −3° | −1° to −2° |

AUGUST promises to be somewhat warmer than the first half of the summer in the western third of the nation, and somewhat cooler than July from Iowa and Minnesota eastward across the Great Lakes Region to the north Atlantic States. August temperatures are expected to average moderately above normal along the Pacific coast, and much above normal over most of the Plateau and Rocky Mountain region from the Canadian border to Mexico. All of this far western area has experienced a cool first half of the summer.

Much above normal temperatures will extend a few hundred miles east of the Divide over the far western Plains, while most of the central Plains area will average only moderately above the normal August temperature, tapering off through near normal to moderately subnormal temperatures towards the central and lower Mississippi Valley, and the central Lakes region.

East of a line from Michigan to extreme eastern Texas, August temperatures will be moderately subnormal. Over the northern third of this area this represents a substantial change towards cooler conditions than those which prevailed during the first half of the summer. Coolest conditions, about three degrees below the normal, will occur along the central and southern Appalachians.

LOUIS BLENDERMANN ON

# PIPING AND PLUMBING

## Preventing Sewage Backflow in Buildings

IN the design of a building's plumbing drainage system, it is of prime importance to provide an adequate system of soil, waste and vent piping. If this system is sized adequately and the proper material is used, years of trouble-free service can be expected. Furthermore, if the building drain and the building sewer are installed with the proper slope, the discharge from the fixtures will be effectively conducted to the outside utilities. When the same consideration is given the storm drainage system, similar results can be expected.

With proper design and ideal site conditions, it is always possible to produce a sanitary or storm system that will ensure favorable results. Sometimes, however, there are certain conditions prevalent at the site which require extra consideration. One such condition is that of sewage backflow which usually originates in the outside sewer lines and is caused by a number of reasons, a few of which follow:

1. Old and overloaded system of sewer piping.
2. Undersized, forced or pumped sewer lines.
3. Sewers, subject to flooding at point of discharge, due to tides, high water and similar reasons.
4. Peak periods of year as during summer, when larger quantities of sewage are handled.
5. The high velocity of flow in sewers caused by tall buildings.
6. Sewer lines that have sagged or settled and retard normal flow.
7. Stoppages in sewer lines.

### Separation of Sanitary and Storm Systems

Where the danger of sewage backflow exists, the first important step to be taken by the engineer, is to design the sanitary and storm systems so that they will be completely independent of each other. This means that the piping of both systems must be installed with separate connections to the outside sewer system or street sewers. If individual sanitary and storm sewers are available in the street, the installation will be simplified. However, if a combined sewer exists, the storm system should be connected to the downstream side of the sanitary connection to this sewer. Figure 1, illustrates the underground piping of the two systems with connections to the sanitary and storm sewers or the combined sewer.

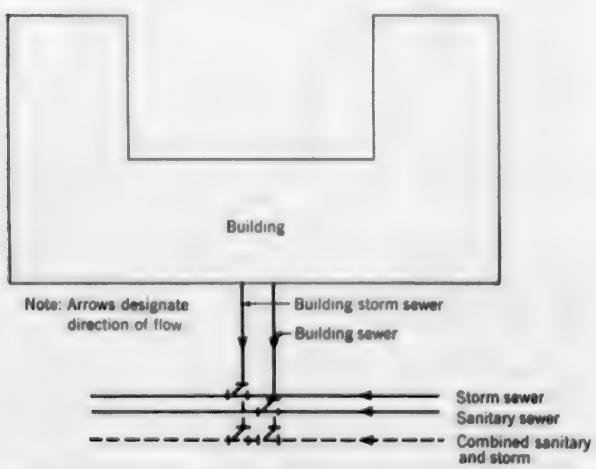



Fig. 1. Typical installation of separate sanitary and storm sewer.

It will be noted in Fig. 1, that both the sanitary and the storm piping are installed as separate systems and connect independently with the outside sewer lines. In the case of the combined sewer, the reason for the downstream connection of the storm system is to prevent the storm water, which is under pressure during a storm by virtue of its total head, from short circuiting into the sanitary system.

### Piping Systems for Buildings with Ground Floors

There are several conditions that require protection from backflow. The first of these conditions is the case of a multistory building with fixtures located on the first or ground floor level. A typical diagram of this arrangement is shown in Fig. 2 where the sanitary and storm systems are separate installations. The storm water system receives the roof water, drops below the ground floor slab and is run underground and out of the building to connect with the storm or combined sewer.

The sanitary system receives the discharge from the plumbing fixtures at the various floor levels and drops under the ground floor slab to receive the discharge from the fixtures at this level. Then it runs underground to connect with the outside sanitary or combined sewer. A building trap and a backwater valve are installed on the building drain in a concrete pit as shown. The concrete pit offers ease of access to the building trap and backwater valve for the purpose of inspection and maintenance. The installation of the building trap, fresh air inlet and backwater valve must be in accord with local code requirements.

The purpose of the backwater valve is to prevent the backflow of sewage into the building where it can flood the ground floor area. The backwater valve consists of a flapper that opens with the normal flow to the street but closes when the flow is reversed.

It will be noted that the sanitary and storm water lines are completely separate systems and do not connect at any point within the building. The reason for this is that any

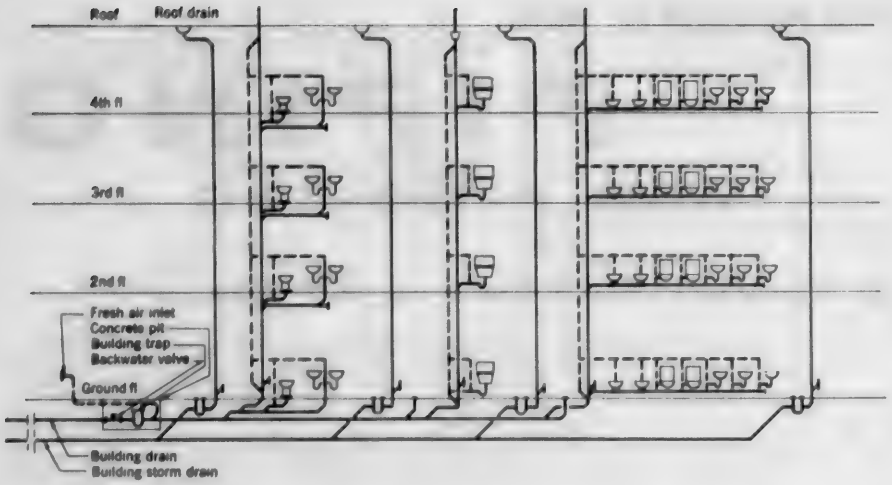



Fig. 2. An arrangement of sanitary and storm drain system within a building.

stoppage in the sanitary system would permit the storm water to flood the ground floor, in the event of a rainstorm or backflow conditions.

### Piping Systems for Buildings with Basement

The other condition for which backflow protection is required is the case of a multistory building with a basement or cellar in which fixtures are proposed. A typical diagram of this arrangement is shown in Fig. 3.

Here again, the sanitary and storm piping are separate systems and connect independently with the street sewers. As shown, the sanitary and storm water lines are installed at the ceiling of the basement or cellar and discharge by gravity to the street sewer. A building trap and backwater valve are installed in the building drain as indicated in the illustration.

Fixtures in the basement or cellar discharge into the drainage line installed under the slab, connecting with the sewage ejector. The sewage ejector lifts the sewage up to the ceiling level where it ties in with the building drain. The check valves shown on the discharge lines at the ejector, prevent the backflow of sewage through the fixtures in the basement or cellar.

The particular hook-up shown for the ejector portrays maximum code requirements for this type of equipment. The unit with included piping should be installed in accordance with specific local code requirements for the area in which the building is to be erected.

### Other Installations

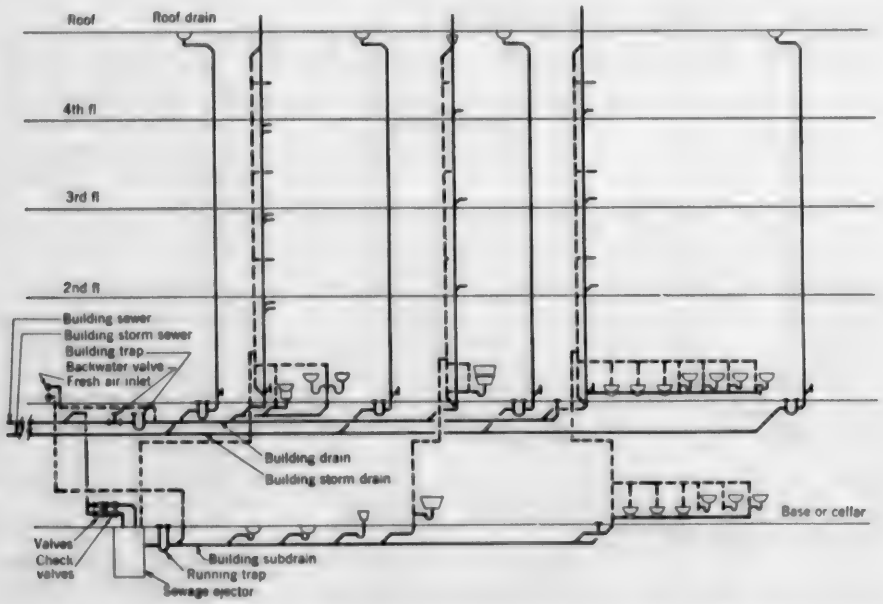
The same recommendations previously illustrated and defined may be applied to similar installations, where backflow conditions are a regular or frequent occurrence.

### Care of the Backwater Valve

When the building drain is laid underground, it is important that the backwater valve be installed in the building drain at a location that provides ease of maintenance. A concrete pit offers the necessary access. Figure 4, shows a typical arrangement of the building trap and backwater valve as installed in a concrete pit.

The backwater valve requires a certain amount of at-

Fig. 3. A typical arrangement of sanitary and storm system within a building which has a basement.



tention since sediment will accumulate on the flapper valve seat thereby preventing the seat from closing tight during the event of backflow. Therefore, the cover should be removed periodically, the sediment removed, and the seat rubbed clean. This practice will ensure the proper function of the valve. When the building drain, including the backwater valve, is installed in an exposed location at the ceiling as indicated in Fig. 3, inspection and maintenance are simplified. However, the same care and attention should be given this valve seat as mentioned. Backwater valves of varied type and manufacture are available for this purpose. Although, all of these valves will serve their function well, they will only continue to work properly if they are kept clean and free of sediment.

### Extra Preventative Measures

Often, in order to provide a more positive protection against sewage backflow, a quick closing valve is installed in the building drain. The valve is similar in operation to a gate valve with the exception that it is equipped with a lever handle for quick closure. The valve is generally located on the street side of the backwater valve. In the event of sewage backflow, the valve can be quickly closed, thereby eliminating the damage that can result from flooding. The danger of a quick closing valve is that although it prevents sewage backflow, it also stops normal flow to the street. As a result, when the valve is closed, steps should be taken in the building to curtail the operation of the plumbing fixtures, until the valve can be safely opened again.

### Parts of System

The component parts of the sanitary and storm system were labeled in accordance with definitions given in the National Plumbing Code, ASA A40.8-1955. Following are the definitions of some terms used as given in the National Plumbing Code.

*Building drain.* The building (house) drain is that part of the lowest piping of a drainage system which receives the discharge from soil, waste and other drainage pipes inside the building and conveys it to the building (house) sewer beginning 3 ft outside the building wall.

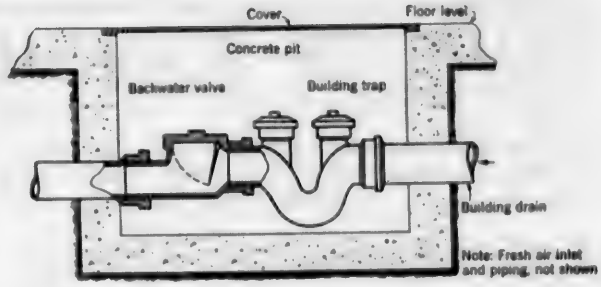



Fig. 4. Installation of a backwater valve.

*Building sewer.* The building (house) sewer is that part of the horizontal piping of a drainage system which extends from the end of the building drain and which receives the discharge of the building drain and conveys it to a public sewer, private sewer, individual sewage disposal system, or other point of disposal.

*Building storm drain.* A building (house) storm drain is a building drain used for conveying rain water, surface water, ground water, subsurface water, condensate, cooling water, or other similar discharge to a building storm sewer or a combined building sewer, extending to a point not less than 3 ft outside the building wall.

*Building storm sewer.* A building (house) storm sewer is the extension from the building storm drain to the public storm sewer, combined sewer, or other point of disposal.

*Building subdrain.* A building (house) subdrain is that portion of a drainage system which cannot drain by gravity into the building sewer.

*Building trap.* A building (house) trap is a device or fitting or assembly of fittings installed in the building drain to prevent circulation of air between the drainage system of the building to be served and the building sewer.

### Summary

When conditions of sewage backflow exist or occur, the design considerations outlined will go a long way in preventing the sewage from entering the building. In addition, if adequate inspection and maintenance are provided at the site, the equipment can be depended upon for proper function. Such preventative measures are the means to stop sewage backflow in a positive manner.

## Temperature Measurements Made by High Speed Planes

A device that will provide more accurate meteorological information for weather forecasting and will result in the reduction of fuel consumption in high-speed aircraft is being developed at Armour Research Foundation of Illinois Institute of Technology, Chicago.

In a project for the Air Research and Development Command, scientists in the Foundation's heat-power research department are studying the application of vortex tubes for the measurement of free air temperature from planes traveling at supersonic speeds. This instrument will enable the new high speed weather observation planes to obtain more accurate measurements of air temperature for predicting weather conditions.

The vortex thermometer also will enable planes to locate jet streams, resulting in the reduction of fuel consumption. A plane flying at an air speed of 200 miles an hour can increase its ground speed to 300 miles by flying in a 100-miles-an-hour jet stream. Other possible applications for the device are in military fire control systems and for refrigeration. Use of the tube for refrigeration has been considered at the Foundation but has been found to be rather inefficient except in special application.

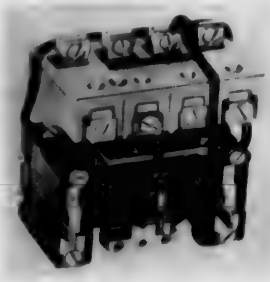
The vortex tube is the first known practical device that will measure this temperature directly, although indirect means have been used previously. In the Armour study, scientists are using the uniflow type vortex tube — a cylindrical pipe which creates a whirlpool, or vortex, when air enters the tube at an angle to the opening.

# NEWS OF EQUIPMENT AND MATERIALS

**Use the convenient prepaid postcard on page 130 for securing additional information on items described in this department.**

## Air Conditioning Motor Starter

Magnetic starters for air conditioning and refrigeration have been designed for the control of hermetic motors by Westinghouse Electric Corp., Pittsburgh, Pa.



Available in two ratings, namely 20 amp continuous with 120-amp locked-rotor current, and 30 amp with 180-amp locked-rotor current, the starters can be furnished either open or in NEMA 1 enclosures and can be applied up to 230v.

The starters have overload relays for close motor protection. The tripping time of the relays matches hermetic motor operating characteristics in order to prevent motor burnouts. They are calibrated at the factory to reduce variations in tripping times and are also sealed there to eliminate malfunctioning due to tampering.

The overload relays are avalable with either hand or remote automatic reset.

More information? Circle Item 1 on postcard, page 130.

## Pipe Insulation

A pipe insulation which provides condensation protection for lines operating at low temperatures or at alternating cycles of high and low temperatures is announced by Owens-Corning Fiberglas Corp., Toledo, Ohio. Known as Fiberglas white dual temperature pipe insulation, the product, for use at temperatures from minus 120 to plus 250 deg F, includes a factory-applied vapor barrier which prevents condensation.

The pipe insulation is made of fibrous glass bonded with a thermosetting binder, and the jacket is composed of a 5-ply laminate including an asphalted Kraft paper for the inner surface and a bleached Kraft paper on the outer surface, the two enclosing a 0.001-in. thickness of aluminum foil.

For pipe sizes up to and including 12-in. diameters, the insulation is furnished in hemi-cylinders with the vapor barrier attached. For pipes of diameters greater than 12-in., it is supplied in three segments to 28-in., in seven segments to 33-in., and the jacket is applied separately. All sections and segments are 3-ft long.

Fastened in place with metal bands, the pipe insulation is available in nominal thickness of 1, 1½, 2, and 2½-in.

More information? Circle Item 2 on postcard, page 130.

## Hospital Incinerator Control

Eliminating smoke and odor nuisances caused by improper combustion in pathological incinerators is the purpose of a control center, Model 245 BP, manufactured by Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill.

The control center is used along with necessary combustion safeguards and starting switches. Capable of functioning at two different set points, it operates at a 600-deg F differential.

Control circuits are arranged so that a burner relay is energized when control temperatures drop below 1600 deg. When the upper limit of 2200 deg is reached, the burner relay is de-energized. The use of the manual switch allows the maintenance of a constant 1600 deg when the incinerator is not being charged.

Inspection and servicing of the temperature measuring and control components is facilitated by unit chassis construction. Control adjustments and settings are made from the front of the control center. The 6-in. indicating scale of the instrument permits the reading of temperatures.

More information? Circle Item 3 on postcard, page 130.

## Valve Fits Four Tube Sizes

A 4-in-1 hermetic port valve, the HP-41, is announced by Madden Brass Products Co., Aurora, Ill. The one valve pierces four sizes of tubing: 3/16, ¼, 5/16, and ⅜ in.

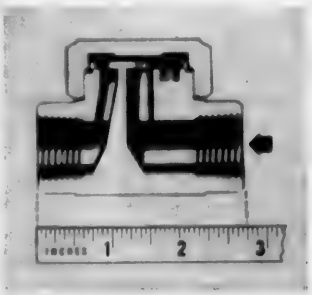
The valve is made for testing, charging, or purging hermetically sealed units. It is made from extruded brass bar and is 2 in. high overall. A recessed sealing gasket permits installation of the valve in any position.

More information? Circle Item 4 on postcard, page 130.

## Steam Trap for 10 to 600 Psi

A steam trap, Type TD-50, that can be used, without any changes, for pressures from 10 to 600 psi has been developed by Sarco Co., Inc., New York, N. Y.

Using the thermodynamic energy of steam to close the valve, the trap operates on light or heavy loads and closes on no load. It operates against back pressures up to 50% of the inlet pressure.




Machined from stainless steel bar stock, the trap consists of three parts, namely, the body, a screwed cap, and the valve head, which is a solid stainless steel disc. Its dimensions are 1¾ x 2⅛ x 2¾ in.

Not affected by water hammer, the trap discharges at saturated steam temperature.

More information? Circle Item 5 on postcard, page 130.

## Welder Is Driven by Engine

A 200-amp, engine-driven welder, for pipeline welding and construction and maintenance work, is announced by General Electric Co., Schenectady, N. Y.

Designated Type WD20AG, the welder is NEMA-rated for a current range of 40 to 250 amp and will handle d-c or a-c/d-c electrodes from 1/16 to ¼ in. There are six electrode taps, one for each different electrode size.

A liquid-cooled, Hercules engine operates the generator at 1750 rpm. It has a 17-gal fuel tank which will keep the generator running over 13 hrs at full-load rating and 60% duty cycle on a tank full of gasoline.

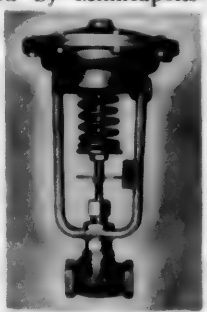
The welder will fit crosswise in a standard pickup truck and has a skid-type base. Lifting and towing eyes are also provided on it.

Bulletin GEC-1333 gives the operating data and specifications of the welder.

**More information? Circle Item 6 on postcard, page 130.**

## Medium-Duty Control Valves

A line of diaphragm control valves designed for medium-duty applications is announced by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.



The valves, designated Series 400, incorporate a number of engineering design improvements to provide better flow characteristics for medium-duty valves. The line includes double-seated, single-seated, and three-way types for use in either on-off or proportional control systems. The on-off single-seated model can be supplied with a plug having a soft composition disc which provides line shut-off. The three-way valve may be used for either diverting or mixing service.

Component parts in the series have been standardized to reduce spare part requirements. The design of the valves makes them suitable for installations in limited space areas.

**More information? Circle Item 7 on postcard, page 130.**

## Suspended Unit Heater

A gas-fired, suspended unit heater, designated as the DNP, is being produced by Day & Night Div., Carrier Corp., Monrovia, Calif. The heater features a delayed-action fan operation which allows the element to heat sufficiently before starting in order to eliminate blasts of cold air. It is installed on built-in hangers with standard IPS threads.

Designed for commercial usage, the heater is approved by the AGA for natural, manufactured, and LP gases. It is available in eight sizes ranging from 50,000 to 225,000 Btu per hr input ratings. Servicing of the unit is accomplished through an access panel on the bottom of the heater.

Sales engineering and installation manuals, as well as sales literature, are availabe upon request.

**More information? Circle Item 8 on postcard, page 130.**

## Fittings for Swimming Pools

Nickel-plated swimming pool fittings are made by Graver Water Conditioning Co., New York, N. Y. The fittings include outlet drains, inlets, wall anchors, and overflow gutter drains.

The screws for the drains screw directly into a metal wall casting rather than into the wall itself, providing drains that are secure yet removable when desired.

**More information? Circle Item 9 on postcard, page 130.**

## Pipe Wrench Can Bend

By a simple ratchet principle, a pipe wrench, called Handi-Flex and manufactured by Tedd Products Co., Rockford, Ill., can be adjusted for use in tight places.

The principle involved in the wrench provides for maximum torque because a firm bite can be made before the position of the handle is determined. The jaws of the wrench can be placed around the pipe, a solid bite taken, and the handle then moved to a good pulling position. By this same method, a pumping action similar to a ratchet wrench can be used.

In addition, the wrench serves the dual purpose of acting as a conventional ½-in. ratchet wrench. This is done by removing a pin separating the head from the handle. By separating the handle in this fashion, it is also possible to utilize interchangeable jaws.

**More information? Circle Item 10 on postcard, page 130.**

## Standard Steam Generators

A series of standard steam generators for industrial plants is announced by Foster Wheeler Corp., New York, N. Y.

Designated SC, the generators are made in nine sizes, with capacities from 50,000 to 150,000 lb per hr. They offer a selection of maximum working pressures to 1500 psi without superheat, or to 1100 psi with superheat; steam temperatures saturated to 950 deg F; oil or gas firing; and a choice of type and location of accessories.

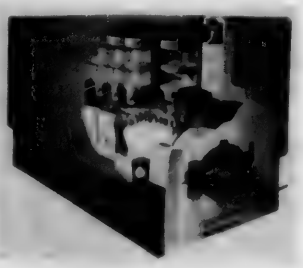
Standardization of the generators, for which standard platforms and combustion controls also are available, enables the company to furnish blueprints and to accomplish fabrication, delivery, and erection, more quickly. In all the steam generators, the equipment requiring operating attention, such as burners and controls, are accessible at the front of the unit.

**More information? Circle Item 11 on postcard, page 130.**

## Boiler Is Designed for Burner

A cast iron, heavy duty boiler has been designed specifically for use with horizontal rotary oil burners by Weil-McLain Co., Michigan City, Ind.

Designated the HR Series boiler, the unit is made with capacities that range to 12,270 sq ft for steam and to 19,360 sq ft for water. It has a high steel base to reduce the amount of brickwork required to obtain the correct burner height.



A feature of the boiler is a steel front plate and section which simplifies the installation of the burner. Drawings are furnished by the company that show the front plate openings and the proper combustion chamber construction for a number of different manufacturers' rotary burners.

The boiler is enclosed in a baked enamel steel jacket and insulated with fiber glass.

More information? Circle Item 12 on postcard, page 130.

## Centrifugal Sump Pump

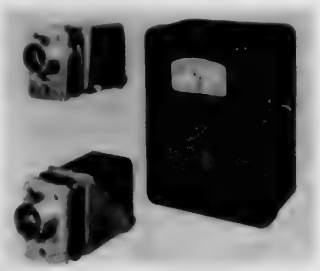
A sump pump, Model 81¼ A-E, that has straight-in suction with no check valve and that operates above the pit is available from Gorman-Rupp Co., Mansfield, Ohio.

The pump's suction and discharge are 1¼ in., and its typical performance is 3000 gph at a total head of 10 ft, or 1800 gph at a total head of 25 ft. The power unit is a standard, face-mounted electric motor that is rated at ⅓ hp, 115v, 60 cycle and 3450 rpm; however, the pump is also available as a basic unit without the motor. Automatic controls start and stop the pump at predetermined water levels, and a float switch or electrodes can be used.

More information? Circle Item 13 on postcard, page 130.

## Smoke or Liquid Densitometer

Photoswitch densitometer, Set P4S, is a photoelectric control made by Electronics Corporation of America, Cambridge, Mass. It helps eliminate the smoke nuisance in industrial smoke stacks and ventilating ducts, monitors light transmission or optical density of liquids in chemical processing lines, and regulates turbidity in water and sewage treatments.



The unit consists of a light source, a photoelectric scanner, and a control unit with a meter. Two meter scales indicate percent transmission and optical density. Control operation is provided at light transmission values from 90% to 0%. A green light indicates normal condition; a red light indicates excess smoke or density condition.

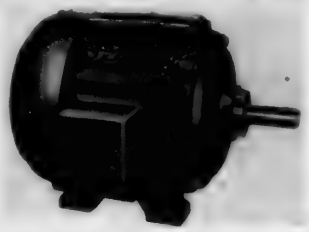
For smoke density control the unit automatically turns off blowers, closes dampers, and operates multiple warning devices. When used in continuous process operations the densitometer will indicate and control the composition of fluids by monitoring their turbidity or variations.

The control relay is energized with light on the phototube, and de-energized when the light decreases to the selected percent transmission.

More information? Circle Item 14 on postcard, page 130.

## Motors Have Re-Rated Frames

Standard and explosion-proof, totally-enclosed motors, with corrosion-resistant, re-rated cast iron frames, improved winding insulation, and heavy duty ball bearings are announced by Wagner Electric Corp., St. Louis, Mo.



Grease fittings are provided at the top and bottom of the bearing housing to permit convenient lubrication and the removal of old grease. A running shaft seal on each end of fan-cooled motors and on the drive end of non-ventilated motors prevents the entrance of moisture, dirt, and other contaminants which might injure the bearings.

The company's current production includes ratings from 1 to 10 hp, 4-pole, 60 cycles in re-rated NEMA frames 182 through 256U. Frames 213 and larger are cast with heavy ribs for cooling. An external fan of bronze or malleable iron cools the motor and prevents dust from collecting on the frame. The flow of air is directed around the sides of the motor by a protective cast iron shield. Smaller ratings are totally-enclosed and non-ventilated.

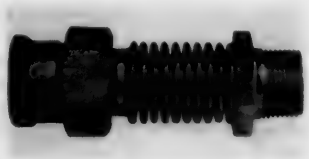
Bulletin MU-203 contains more information on the motors.

More information? Circle Item 15 on postcard, page 130.

## Nipple Corrects Misalignment

A bronze-brass flexible nipple is made by Techniflex Corp., Port Jervis, N. Y., for misaligned header-to-boiler connections; for use where piping misalignment is encountered; or where moderate vibration or pipe movement due to expansion and contraction is a problem.

Standard units are provided in sizes ranging from ⅜ to 2½ in. IPT, with a union fitting on one end and a male fitting on the opposite end. The flexible portion consists of bronze seamless tubing with annular convolutions that permit stretching, bending, or compressing to fit into an available space. Using a flexible connection where misalignment is present permits tight connections and prevents shearing pipe or nipples under strain.



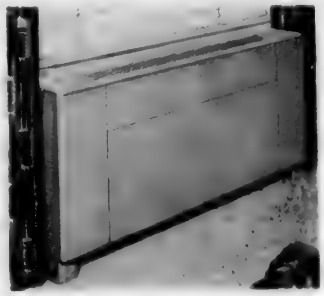
Assemblies are also available with fittings and to lengths desired by customers through plumbing supply wholesalers.

More information? Circle Item 16 on postcard, page 130.

## Room Conditioners

Room conditioners, called Diaflo, for summer cooling and winter heating in multi-room structures are available from American Blower Corp., Detroit, Mich. The units are suited for installation in hospitals, hotels, motels, offices, schools, and public buildings.

Full depth, including enclosure, of all models is 9¼ in. When the unit is semi-recessed, the enclosure extends 7 in. into the room. The factory-built enclosures are the slip-on type which are mounted over the basic unit after the piping and wiring has been completed.



Either throw-away or cleanable filters can be used with the units. The filters are inserted or removed through an opening at the bottom without removing the enclosure.

The electric drive motor is equipped with a 2-speed switch which is accessible through the enclosure top. A mechanical interlock closes the outside air damper when the motor switch is off.

The conditioners are available in five sizes having nominal unit lengths of 18, 27, 39, 48, and 54 in. with rated air deliveries ranging from 200 to 600 cfm. They consist basically of three parts: the basic unit, the enclosure, and enclosure cover.

The conditioners can be installed vertically on the floor as free-standing, fully-recessed, or semi-recessed units. Their design also permits horizontal ceiling installation. The enclosures are available in prime coat for painting to match building interiors.

More information? Circle Item 17 on postcard, page 130.

## Pump Has 3-In. Discharge

A submersible sewage ejector with a 3-in. discharge is being produced by Weil Pump Co., Chicago, Ill. The pump is a heavy duty, screenless type with a bladeless impeller that is designed to pump raw sewage.

Made for continuous operation during extreme and overload periods, the pump is self-contained with sealed bearings that require lubrication once every five years. The motor and bearings are hermetically sealed. The impeller, drive shaft, housing and motor are an integral and interchangeable unit. A Neoprene-covered cable, encased in an armored guard, is used from the pump to the control panel.

Multiple pump installations are furnished with controls to program the operation and combine individual units for load requirements.

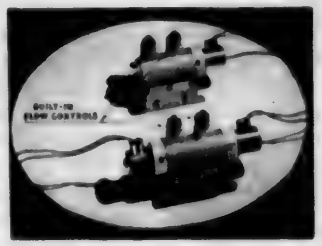
The pump is available with motor ratings of ½, ¾, and 1 hp and with capacities to 150 gpm.

More information? Circle Item 18 on postcard, page 130.

## Pilot-Operated Control Valves

Double and single solenoid, pilot-operated control valves are available from Airmatic Valve, Inc., Cleveland, Ohio.

The valves are recommended for machine applications where continuous operation and compact piping are needed. Both have built-in flow controls which make them dual-purpose valves. There are two internal moving parts: a single balance spool-type stem that rides on aircraft-type packing, and the solenoid pilot plunger with molded-in seats. The double-solenoid valve has two solenoid pilot plungers. The entire unit is sealed so that outside matter does not hinder the internal operation.



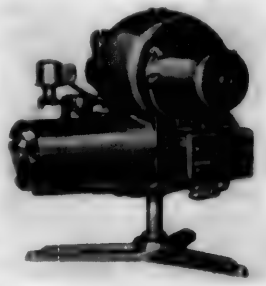
The double-solenoid, Model SS, can be energized through a micro-switch or a relay. There is no need to energize it continuously, although the valve must be mounted on its horizontal axis. The single-solenoid valve has a spring return for electrical control, and electrical contact must be maintained for the duration of the cycle.

The solenoids are rated as continuous duty with a maximum power consumption of 10 watts. The valves are available in the following sizes: ¼, ⅜, ½ and ¾ in., with pipe-tap size ports. Recommended pressures are from 20 to 150 psi air pressure for the double solenoid and from 35 to 150 psi for the single solenoid.

More information? Circle Item 19 on postcard, page 130.

## Burners Fire Against Pressure

Power pressure burners are available in straight-oil, straight-gas, and combination gas-oil from Ray Oil Burner Co., San Francisco, Calif.



All three type burners function against positive pressure and special modifications are available to fire against positive firebox pressures up to ¾ inch of water, which generally eliminates the need for induced or forced draft fan equipment. The burners have ratings to 2,500,000 Btu per hr input, with no secondary auxiliary air required. All are automatic, and, on the combination burner, a switch changes from one fuel to another.

Integrally mounted controls, wiring, and fuel valve piping, make the burners suitable for packaged boiler-burner units.

In the pressure-combination burner's ignition system, the conventional gas pilot has been eliminated, and the main gas flame is ignited from a momentary oil firing cycle. This results in a nozzle purge with each firing cycle.

More information? Circle Item 20 on postcard, page 130.

## Machine Makes 180-Degree Bends

An automatic-cycle tube bending machine that will simultaneously form two 180-deg hairpin bends in ferrous or non-ferrous, finned or plain tubing in less than three seconds is announced by Walter P. Hill, Inc., Detroit, Mich.

Insertion of the tubing into the machine initiates an automatic bending cycle in which the tubing is bent and ejected after bending. The machine has a welded base which houses electrical controls and a built-in hydraulic pump, motor, and tank unit.

In the operation shown, two ⅜-in. diameter, 0.016-in. wall thickness copper tubes are bent to form 180-deg hairpin bends and the legs are levelled before ejection. Tube support mandrels are provided for each tube. The machine will also handle ½, ⅝, and ¾-in. diameter tubing with minor clamp and radius block changes.

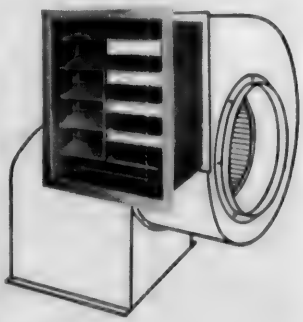
The machine has a single-tube capacity of up to 1-in. diameter. The center-to-center bend radius that can be formed on the machine is proportional to the tube diameter and wall thickness. Bends having legs up to 4-ft in length can be handled by the machine.

A 5-hp motor and 12-gpm pump provide hydraulic power for the actuator and clamp cylinders. The tube bending machine occupies floor space about 30 by 72-in. and is 32-in. high overall.

**More information? Circle Item 21 on postcard, page 130.**

## Shutter for Unit Blowers

A new model automatic shutter, designed for unit blowers, is placed on the market by Elgo Shutter & Mfg. Co., Detroit, Mich.



Built in sizes to meet customers' needs, the shutter is self-contained in an adapter sleeve so that it may be attached to the blower. Its louvers are made of light gage aluminum with felt silencer strips and rust-proof hinge rods. The hinge rods ride in bronze bearings.

The shutter is weatherstripped to prevent the entrance of rain, snow, and wind and also to prevent backdrafts.

**More information? Circle Item 22 on postcard, page 130.**

## Industrial Flocculating Agent

A synthetic resin flocculating agent for use in disposal or recovery operations involving clarification, sedimentation, or filtration, has been developed by B. F. Goodrich Chemical Co., Cleveland, Ohio.

Called Good-rite K-720, the material serves to collect small solid particles into larger clusters. The formation of clusters, or floc, facilitates separation of the dispersed solids from the liquid. The agent improves the degree and rate of sedimentation and at the same time improves the filtration rate characteristics of dispersed solids. In filtration, flocculation with the resin forms a porous filter cake with a resultant reduced pressure drop.

The resin is also available as a 20% water solution identified as Good-rite K-720S.

**More information? Circle Item 23 on postcard, page 130.**

## Fans Exhaust Corrosive Fumes

A line of belt-driven, tubeaxial propeller fans, designed for handling corrosive exhaust, high temperature and explosive fumes, is introduced by Propellair Div., Robbins & Myers, Inc., Springfield, Ohio. Available in five sizes from 16 to 36 in., the fans have air delivery ratings to 26,000 cfm and are designated Type BT by the manufacturer.

The fan drum is rolled from 12-gage steel plate. Integrally rolled mounting flanges and a continuous welded seam prevent fume or condensate leakage and subsequent corrosion. The belt housing is also formed of 12-gage steel plate.

The motor-mount assembly permits a 3-in. belt adjustment and is drilled to accommodate motors from ¼ to 5 hp and 1725 rpm. The V-belts are resistant to high temperature and are oil-proof; they are selected for a minimum rating of 140% of fan horsepower.

A one-piece cast-iron housing isolates the fan bearings from the polluted air stream. Three bearing assembly designs are available: totally-enclosed, ventilated, and corrosion resistant.

Special corrosion-resistant coatings for the fan are applied at the factory, if desired.

**More information? Circle Item 24 on postcard, page 130.**

## Compressor-Condenser Bushing

An interchangeabe bushing that can be installed on existing compressor-condenser units is announced by Maurey Mfg. Corp., Chicago, Ill. The bushing, known as Type XBF, is used with 1, 2 and 3-groove combination A and B groove pulleys on high pressure suction and blower applications from 10 to 16 inches in diameter.

Mounted on the drive shaft, the bushing permits the use of larger V-drives, with greater horsepower ratings, to increase compressor speed. It accommodates standard industrial V-pulleys with extra grooves and makes it possible to replace a 2-belt drive with a 3-belt drive. By permitting the use of standard V-pulleys, it reduces the cost of pulley replacement by eliminating the need for special pulleys.

A descriptive XBF folder is available on request.

**More information? Circle Item 25 on postcard, page 130.**

## Convectors Are Redesigned

A line of convectors incorporating 30 different types and over 8000 sizes is introduced by Modine Mfg. Co., Racine, Wis. With the exception of the company's Type F deluxe floor cabinet, all the enclosures have been redesigned to give architects and engineers greater freedom in adapting convectors to modern building design.

Included in the line are free-standing, fully and partially recessed, concealed (plaster front), and wall-hung models. Most of these types are offered in standard gage enclosures as well as in heavy-gage enclosures for heavy duty institutional applications. Knob-type dampers, which can be installed at the factory or added later, are furnished as optional equipment.

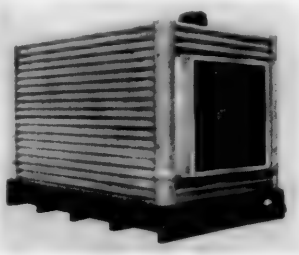
The convector heating units for the line have also been redesigned to simplify their installation.

The specifications, dimensions, and performance data of the convectors are contained in catalog 255.

More information? Circle Item 26 on postcard, page 130.

## Cooling Towers Made of Wood

A line of wooden, mechanical draft, cooling towers is announced by The Marley Co., Kansas City, Mo. Designed to serve air conditioning or refrigeration equipment in capacities from 5 to 50 tons, the wooden towers supplement the company's present line of steel cooling towers and will be marketed under the trade name wood Aquatower.



The towers have a forced draft, cross-flow design with a vertical air discharge. The vertical air discharge permits the towers to be located close to building walls on all sides except the air intake side. Mechanical equipment is located out of the hot air discharge stream.

Packaged models are being made up to and including 15 tons. Larger models, 20 through 50 tons, are made of redwood with horizontally corrugated, asbestos cement board casing. The large models are shipped unassembled to simplify hoisting.

More information? Circle Item 27 on postcard, page 130.

## Compounds Seal Clay Pipe

Molding compounds that permanently seal joints between lengths of clay pipe are made by The B. F. Goodrich Co., Industrial Products Div., Akron, Ohio. Called Koroseal, the compounds are supplied in liquid plastic form to clay sewer pipe manufacturers, who process the material into flexible sealing rings.

Contractors receive the clay pipe with the rings of material molded permanently at the ends of each pipe section. At the shaft end of the pipe, a ring is molded to the outside surface; at the bell end of the pipe, a ring is molded to the inside surface of the bell. When the two ends are pushed together, the rings squeeze tightly against each other to form a mechanical, compression seal.

Clay sewer pipe manufacturers licensed by B. F. Goodrich to use the joint are producing the pipe in diameters of 4, 6, 8, and 12 in.

More information? Circle Item 28 on postcard, page 130.

## Gas Detector Is Portable

A portable instrument for detecting combustible gases and vapors is called the J-W Sniffer Model G and is made by Johnson-Williams, Inc., Palo Alto, Calif.

As with previous models, the new detector is designed to be worn waist-high, suspended by a carrying strap around the neck. Its dimensions are 3 x 4⅜ x 5¾ in., and it weighs, including a complement of eight batteries, slightly over four pounds.

To increase the life of the batteries, the on-off switch is integrated with the aspirator bulb in such a way that grasping the bulb to draw in a sample automatically turns the indicator on. When the bulb is released, the instrument is shut off. This arrangement insures that the batteries will be used no longer than necessary and that the instrument will not be left on unintentionally.

More information? Circle Item 29 on postcard, page 130.

## Infra-Red Unit Heater

A gas-fired unit heater that needs no electrical connections is announced by Thermobloc Div., Prat-Daniel Corp., South Norwalk, Conn. The heater, named the overhead Panelbloc, directs infra-red rays downward to heat objects or people, but not the surrounding air, in its effective range.

The heater is available in two sizes, Model CR 63 with an input of 62,500 Btu per hr, and Model CR 125 with an input of 125,000 Btu per hr. Natural, manufactured, mixed, or LP-air gas may be used as fuel. The equipment is approved by the AGA and may be furnished for either manual or thermostatically controlled operation.

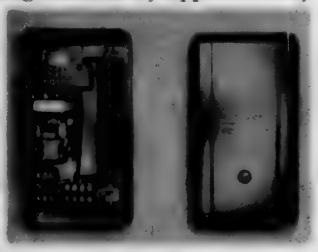
In addition to their use for plant heating, the heaters are suitable for area, or spot heating. In super-markets, for example, heat can be concentrated on the check-out counters, and little or no heat need by supplied to those areas where frozen foods, produce, or meats are on display.

More information? Circle Item 30 on postcard, page 130.

## Step Starting Accessory

A step-starting accessory for air conditioners, which reduces light flicker in house lighting circuits, is announced by General Electric Co., Schenectady, N. Y.

The starter reduces starting currents by approximately 50 per cent and saves on extra costs of heavier lines and transformers ordinarily required with full-voltage starting.



After temporary power failures, due to lightning or other causes, the step starter will hold an air conditioning load to half its normal inrush current for several seconds. This allows other motor loads such as a refrigerator, washer, and fans to restart before the full air conditioning load comes on the line.

An increment-type device, the step starter is mounted as an external accessory and consists of a contactor, timing relay, and resistor.

In the first step of operation, the resistor is in series with the motor for approximately two seconds, limiting inrush current by one-half. After that interval, the timing relay shorts out the resistor, giving a second increase in current, which diminishes as the motor gains speed.

Available in two ratings, the step starting accessory can be connected with the built-in starter for 3- and 5-hp, single-phase air conditioning units.

More information? Circle Item 31 on postcard, page 130.

## Pincers Tighten Hose Clamp

A general purpose hose clamp that can be fixed in place in three seconds with an ordinary pincers has been developed by Circle Clamp Corp., New York N. Y.

Made of one piece, the clamp can be used in the heating, ventilating, air conditioning, and power industries with and in the manufacture of such equipment as motors, compressors, pumps, boilers, switch boxes, fire extinguishers, and welding equipment.

The clamp is round with U-shaped folds or lugs. Smaller size clamps have two lugs and the larger ones, three. The device is slipped on the hose or part and crimped in place by squeezing the parallel sides of the lugs together with the pincers.

There is no danger of the pincers slipping because the pressure of the jaws is approximately perpendicular to the surfaces of the parallel sides. The decrease in the clamp diameter is determined by how far the lugs are closed. To remove the clamp, the lugs are snipped off with the pincers.

Every clamp is marked with minimum and maximum diameters of the hose or tube for which it is applicable. The proper size clamp is determined by measuring the diameter of the part to be clamped with calipers. For hose and tubing applications, the nipple should be inserted before measuring to obtain true outside dimensions.

Made from various ferrous and non-ferrous metals, the clamps are available in 20 sizes ranging from ¼ to 2⅝ in. ID. Larger sizes are produced on special request.

More information? Circle Item 32 on postcard, page 130.

## Latch Fastens Panels

A fastening device called the Paneloc rotary latch is announced by Scovill Mfg. Co., Waterbury, Conn. It is for use on hinged or removable parts, such as inspection doors, access panels, covers, and electrical control panels.

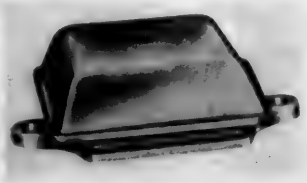
Made of cadmium-plated steel, the latch consists of four parts: a latch-screw, a shim plate, an anchor block, and a latch-nut. It is assembled on the access panel only. Operating with a quarter turn, it reduces the removal time of panels, doors and covers.

Three standard sizes are currently available, and other sizes can be furnished on special order.

More information? Circle Item 33 on postcard, page 130.

## Mounting Is Loaded in Shear

A line of vibration mountings for medium and heavy weight machinery has been developed by T. R. Finn & Co., Inc., Industrial Div., Hawthorne, N. J. Trade-named Finnflex, the mounting is a heavy-duty, rubber-in-shear vibration mounting.



The basic design of the mounting consists of a pair of rubber-in-shear isolators mounted at an angle between a semi-steel base and cover. The isolators are loaded primarily in shear. The rubber's inherent damping restrains excessive motion of the equipment. The rubber also reduces the transmission of sound to or from the mounted equipment. In addition, compression loading of the isolators minimizes the effect of shock and overload; the degree of shock protection can be controlled by a pre-loading nut on the mounting.

Metal parts enclose and protect the rubber isolators against accidental damage. The loaded over-all height of the mounting is 3 in. It is available with non-walking, rubber-bottomed baseplates which eliminate creeping or walking of the equipment, and make it unnecessary to lag it to the floor. The load capacities of the mounting range from 500 to 2500 lb per mounting.

More information? Circle Item 34 on postcard, page 130.

## Valve Ratings Are Increased

Increased capacity ratings for relief valves in sizes ½ to 1 in., for both Freon and similar refrigerants and ammonia, are announced by Henry Valve Co., Melrose Park, Ill. The valves are constructed in accordance with the requirements of the ASME Unfired Pressure Vessel Code and carry the official marking symbol indicating National Board approval and capacity certification.

More information? Circle Item 35 on postcard, page 130.

## Cooler Has Duct Connections

A multi-purpose air conditioning unit, the Imperial, which can be used as a window air conditioner, or with conventional, rectangular ductwork is announced by Rheem Mfg. Co., Chicago, Ill.

When used as a window unit, the air conditioner is equipped with a conventional front panel. When it is used with ductwork, it has 10 x 14-in. supply and return air duct connections, as illustrated.

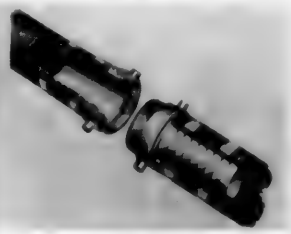
With ductwork, the air conditioning unit can cool several rooms of a home, or a variety of shops and small stores. It is weather-proof, and may be installed on a roof, in an attic, or in any location that may be conveniently situated with respect to the part of a building to be air conditioned.

The unit is available in ¾ hp, for air conditioning areas up to 500 sq ft; 1 hp, up to 700 sq ft; 1½ hp, up to 900 sq ft; and 2 hp, up to 1200 sq ft.

**More information? Circle Item 36 on postcard, page 130.**

## Hose Coupling

A union shank hose coupling, designed for handling liquid where suction or discharge is involved, is announced by Universal Valve Co., Elizabeth, N. J.



A replacement pin lug or hex swivel nut and a cast-in flange are two of the features of the coupling. A tie wire, which secures the swivel ring to the shank, permits replacement of the ring should the threads ever be damaged, thus reducing the necessity of discarding the entire unit.

The cast-in flange of the coupling acts as a cushion upon which the hose end rests. This prevents the hose from interfering with the swivel action or the hose fabric material from becoming frayed. A groove on the flange provides abundant anchor area for hold-back wire where wire is required to prevent pulling the hose apart under severe pressures.

Designated as No. 800, the coupling is available in 2 and 3-in. sizes. Other sizes are available on request.

**More information? Circle Item 37 on postcard, page 130.**

## Improved Insulation Feeder

A feeder which enables insulation applicators to select the best blowing speed for each insulation job has been developed by Universal Insulating Co., Van Wert, Ohio, for its Uni-Matic insulating machines. The feeder is now standard on Models W-47, W-59, IH-47, and IH-59.

Combined with a 4-speed gearshift transmission and engine throttle control, the feeder's larger capacity permits applicators to utilize a range of blowing speeds from 15 bags (35 to 40 lb each) of insulation material an hour to 60 bags an hour.

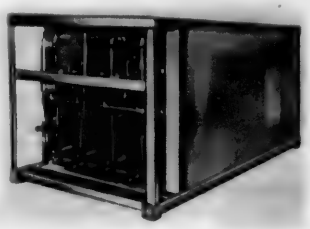
A feature of the feeder is a hinged baffle which adjusts the feeder opening to any required size from 5 by 12-in. to 8 by 12-in. When a change of blowing speed is desired, the feeder opening baffle is adjusted to accommodate the increased or decreased flow of insulating material. The feeder is approximately 50% larger than previous models.

The end plates are removable for access to the six-wing rotor for adjusting the wiper blades. The open end rotor is made of electrically welded steel, with rubber seals on the ends as well as on the sides of the blades. The seals can be adjusted to compensate for wear on the end plates and the housing. Hose connections to the unit are standard 2½ or 3 in.

**More information? Circle Item 38 on postcard, page 130.**

## Ice Bank for Air Conditioning

Ice bank refrigeration units for chilled-water air conditioning are manufactured by The King Zeero Co., Chicago, Ill., with storage capacities from 500 to 30,000 lb of ice.



Designed to operate with Freon, ammonia, or methly-chloride refrigerants, the units provide 32- to 34-deg F sweet water to chilled-water air conditioning systems. They are made to store sufficient ice for air conditioning load durations of 8 hrs per day.

A total of 94 models are made by the company for storing from 72,000 to 4,320,000 Btu in 2½-in. thick ice.

**More information? Circle Item 39 on postcard, page 130.**

## Protective Coating Is Rubbery

A Neoprene base protective coating, Corrocote No. 362, that guards surfaces against moisture, oils, chemical fume and splash, salt air, and fungus corrosion, has been developed by Chemical Coatings & Engineering Co., Broomall, Pa.

Applied by roller, brush, spray, or dip, the film dries and self-vulcanizes to form a rubbery barrier. The addition of oils or plasticizers is not necessary in order to obtain an elasticity which resists cracking. The cured film resists abrasion, sunlight, and weather; will not support combustion; is a non-conductor; and counteracts electrolytic corrosion.

Coatings can be exposed to continuous air temperatures up to 250 deg F and intermittently to 300 deg. Films of 0.003 to 0.005-in. thick can be applied, per coat, to cover sharp edges, welds, or corners.

It is available in gray, black, aluminum and red, and its applications include: the exteriors of pipes, tanks, vats, and ducts; use on valve parts, bushings, air conditioning and ventilating equipment; and as a lining for fans, impellers, and ducts.

**More information? Circle Item 40 on postcard, page 130.**

## Condensers Are Air Cooled

Air cooled condensers produced by A. H. Witt Co., Los Angeles, Calif. are designed for single or multiple compressor installation and furnished for indoor and outdoor installations.

Requiring no water the condensers are recommended by the manufacturer for installations where water supply is limited or taxed, where drainage facilities are inadequate, where local laws limit the use of city water for condensing purposes, or where water has a corrosive action on water cooled condensers.

The condensers' nominal tonnage is based on 90-deg ambient and 115-deg condensing temperatures. For different ambient and condensing temperatures, the company's correction factors apply. They are offered in a range of sizes of from 2 to 10 tons, inclusive, or any multiples thereof. The same units are applicable for indoor or outdoor installation.

Fabricated from copper tubing and aluminum fins, the coil cores are housed in a heavy casing. They are so designed as to require no change for indoor or outdoor installation.

More information? Circle Item 41 on postcard, page 130.

## Damper for Round Pipe

A prefabricated damper ready for installation in round pipe is manufactured by Duro-Dyne Corp., New Hyde Park, N. Y.

The Jiffy regulator, which was formerly made by Parker-Kalon and is now made by Duro-Dyne, is pre-attached to a corrosion-resistant, coated damper blade.

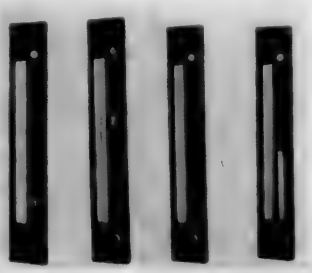
The damper has a steel threaded bearing with no loose parts.

Two styles of damper are available. The JD Series uses one bearing. The JDS Series is the same as the JD series with the addition of a pre-attached patented P-K Spring-Loc bearing. The JDS Series damper is desirable for higher velocities.

More information? Circle Item 42 on postcard, page 130.

## Remote-Reading Tank Gages

A new series, No. 14000, of Petrometer remote-reading, liquid depth gages is available in four models from Liquidepth Indicators, Inc., Long Island City, N. Y. Models A, B, F and M, from left to right, are illustrated in the photograph.



The gauges are designed for measuring the depth and quantity of liquids in storage tanks and process vessels of chemical, petroleum, paint, food, and other process industries. They can be installed on tanks up to 50 ft deep, located above or below the ground and up to ¼ mile away.

The indicators operate on the principle of hydrostatic pressure. The pressure exerted by the weight of the liquid in the tank is transmitted pneumatically through a copper tube transmission line to the liquid column in the indicator.

More information? Circle Item 43 on postcard, page 130.

## Device Analyzes Sun Effects

A portable device for visualizing and duplicating the effect of the sun on buildings and projects is introduced by Hoyt Rust, Denver, Colo.

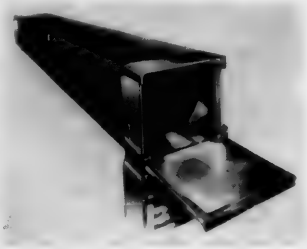
By setting the device for various conditions, scale shadows can be cast on a model or project that is placed into the correct position with respect to the sun or an artificial light. Conditions for any latitudes, orientations, days of the year, or times of the day can be simulated by the device. In using the analyzer, all results, employing either sunlight or artificial light, are in terms of true north and solar time.

The price of the analyzer includes instructions, charts, a direction indicator, and an eave attachment.

More information? Circle Item 44 on postcard, page 130.

## Tube Stores Tracings

An interlocking file for tracings and blueprints has been developed by Pack Mfg. Co., Logan, Utah.



Called Inter-Lock, the file is a self-contained unit made by housing a round tube inside a square one and locking both between die-cast ends. They dovetail together to form blocks of any desired size and shape.

Fitted with spring-loaded die-cast doors for indexing, the file is available in any specified length. Present models measure 2½ in. between centers, when assembled; other sizes will be available.

More information? Circle Item 45 on postcard, page 130.

## Lighter Weight Framing

Lightweight metal channels and fittings, designated A Series, are announced by Unistrut Products Co., Chicago, Ill. The channels are designed for the construction of shelving, racks, framing, and mechanical and electrical supports that do not require the weight and strength of the company's present P Series channels and fittings.

The new series retains the same basic components of the present one. It requires a hacksaw and wrench to erect and is cut to length and bolted together from stock fittings.

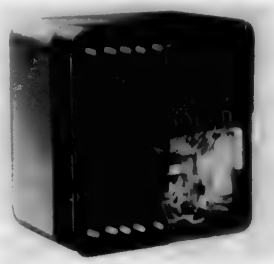
Available in three sizes: A-1000, 1¼ x 1¼ in., 14-gage; A-4000, ⅝ x 13/16 in., 19-gage; and A-5000, 1¼ x 2½ in., 14-gage; the channels are made in lengths of 10 and 20 ft.

More information? Circle Item 46 on postcard, page 130.

## Burner Safe-Start Circuit

A circuit that automatically proves the electronic circuitry in gas or oil burner controls is announced by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Used in the RA890 relay, the additional circuit automatically breaks the relay's starting circuit whenever a false signal of flame is present, either from internal or external causes, following a power failure or manual power interruption. This is done by cycling the flame relay after each interruption to prove the vacuum tube circuitry before permitting the burner to start. If the flame relay holds during this inspection cycle, the safe-start circuit breaks the starting circuit internally, preventing the flow of fuel into the burner.



The relay eliminates the need for time-delay devices to hold the circuit open for a predetermined period to provide for tube warm-up.

To meet code requirements of certain sections of the country, the unit may also be equipped with an additional relay, designated the R482D, to provide cutoff sequence and system shutdown within 2 to 4 sec. in case of flame failure.

More information? Circle Item 47 on postcard, page 130.

## Device Dumps Boxes

An hydraulically-operated box dumping device is introduced for Transveyor trucks manufactured by Automatic Transportation Co., Chicago, Ill.

Designed for use with Dump-O-Matic or similar loose-bottom boxes used for handling loose material, such as scrap or parts in process, the device consists of an extra mast that has been fitted with a face plate. In operation, the forks of the truck are first raised to dumping height; the face plate then engages the lip of the loose-bottom box and raises it high enough to dump its contents.

The attachment is controlled from the operator's position, and operates from the truck's hydraulic system. The capacity of the unit shown is 2000 lb.

More information? Circle Item 48 on postcard, page 130.

## Pump Sizes Are Increased

Five sizes are added to the SA Series of submersible pumps manufactured by The F. E. Myers & Bro. Co., Ashland, Ohio. The five sizes are ¾, 1, 1½, 2, and 3 hp.

With the addition of the new sizes, the company offers a submersible pump to supply water requirements for homes, farms, schools, dairies, waterworks, nurseries, and industrial plants.

The pumps use a pancake stage principle where high pressures or extreme well lifts are needed. A turbine bowl construction is employed where maximum capacities at low heads are needed.

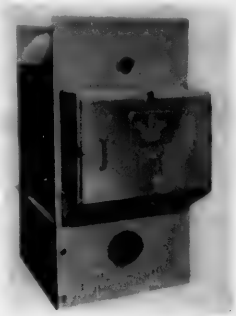
All working parts of the submersible pumps which come into contact with water are made of corrosion resisting materials such as bronze, brass or stainless steel. A highly refined oil lubricates the bearings and the seal, insulates the windings, and keeps the motor from overheating.

More information? Circle Item 49 on postcard, page 130.

## Flue Door Is Redesigned

A redesigned front flue door for its Windsor, Type C and LWL Series, residential and commercial boilers is announced by Portmar Boiler Co., Brooklyn, N. Y.

Suitable for restricted stacks and poor flue construction, the door is steel stamped of flanged and dished construction. It is made of heavy gage steel and is insulated for cool operation.



The design of the door provides increased furnace volume on all boiler sizes and cleaner operation of combustion gases with oil, gas, and stoker firing. Also all tubular heating surfaces of the boilers are accessible through the front flue door for cleaning and inspection.

More information? Circle Item 50 on postcard, page 130.

## Conditioner Has Twin System

Self-contained air conditioners, designed for commercial, industrial, and institutional establishments, are added to the Master-matic air conditioning line by Frigidaire Div., General Motors Corp., Dayton, Ohio.

Made in 10- and 15-ton sizes, each model has a twin cooling system. One of the systems can be operated during warm weather, and both systems will operate automatically during periods of extreme heat and humidity. The twin systems eliminate both under-cooling and over-cooling.

Located at the top of the cabinet, the blower sections can be adjusted so that the conditioned air may be discharged to the front, back, or top. If remote installation is desired, the compressor section can be separated from the cooling section.

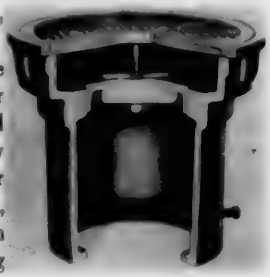
Refrigeration is furnished by two XD Meter-Miser compressors. The units are the sealed reciprocating type, with direct drives. For year-round service, steam heating coils are available.

The overall dimensions of both models, including an accessory hood, are 93⅝ in. high, 67 in. wide, and 29½ in. deep.

More information? Circle Item 51 on postcard, page 130.

## Clean-Out Adjusts to Floor

An adjustable floor clean-out is placed on the market by Norman Boosey Mfg. Co., Detroit, Mich.



Designated as the 812A, the clean-out can be adjusted for any floor level. Its body is held in place during construction by three set screws which center the pipe in the clean-out body, in order to prevent it from moving while concrete is being poured.

The clean-out is available with brass, chrome, or Illinois metal top finishes.

**More information? Circle Item 52 on postcard, page 130.**

## Multiple-Burner Control System

An integrated control system has been designed for safely starting and operating multiple-burner boilers by Combustion Control Div., Electronics Corporation of America, Boston, Mass. It consists of a pre-wired and tested control cabinet assembly with the necessary controls, timers, valves, and accessories for a complete installation.

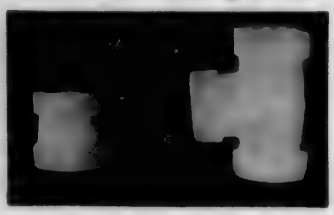
The system provides protection from starting and operating flame failure for one, two, three, or four burners, whether gas, oil, or gas-fired; manually or semi-automatically ignited. Flame failure protection is provided for each burner by two Fireye Type 48PT1 scanners; one monitors the pilot flame and the other the main flame. The system does not allow the main fuel valve to open until the pilot flame is established. It does this by requiring a purge time of sufficient length to produce four air changes in the boiler, at the end of which time a green light flashes to show the operator he can continue the light-off procedure.

A timer limits the trial-for-ignition for each burner to 10 sec, after which time the fuel valve closes if the main flame is not ignited. When a flame failure occurs at any burner during light-off or operation, an alarm horn sounds and a red alarm light for that burner is illuminated. The alarm light remains on until the burner is restored to normal operation. A switch is provided for silencing the horn.

**More information? Circle Item 53 on postcard, page 130.**

## Polyethylene Fittings

The addition of two lines of polyethylene fittings, threaded fittings (illustrated) and sleeve fittings, is announced by Arthur S. LaPine & Co., Chicago, Ill.



Each line includes elbow bends, short tees, swept tees and swept bends. The threaded line also includes a half coupler with a male thread and a half coupler with a loose nut. There is also a blanked screw cap for cleaning. A stainless steel band clamp is available for connecting the sleeve fittings.

All fittings and pipe are 1½ in. ID, actual dimension, not nominal, and are interchangeable. The 1¾-in. OD pipe is furnished in lengths of 1 and 6 ft. They are made of natural white polyethylene.

**More information? Circle Item 54 on postcard, page 130.**

## Room Cooler Fits in Closet

A remote room air conditioner, the Recold Model RE, that can fit into an unused area, such as the space above a closet shelf, is available from Refrigeration Engineering, Inc., Los Angeles, Calif., in three sizes for direct expansion systems or chilled and hot water systems.

Made for multiple installation in motels, hotels, residences, and offices, the unit is individually controlled and requires no ducts; its cool air outlet can fit between studs. It is furnished enclosed with an electrical connection box.

For new buildings, the motor assembly may be installed after the job is completed to avoid theft or damage.

**More information? Circle Item 55 on postcard, page 130.**

## One-Piece Grille Assembly

Return air grilles in a one-piece assembly are manufactured by Titus Mfg. Corp., Waterloo, Iowa, for any size grille opening. The purpose of the one-piece assembly is to eliminate the necessity of butting smaller grilles together.

The grilles have curved, hemmed fins which prevent a person from seeing through the grille when it is used in lower wall areas.

**More information? Circle Item 56 on postcard, page 130.**

## Valve Separates Boiler Air

A control valve, the QS No. 102 Ventflo, for keeping the air at the top of a boiler from passing into the radiator system is announced by Quality Specialty Co., Inc., Camden, N. J.

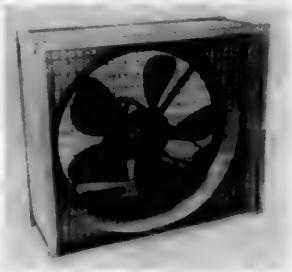
Air is prevented from entering the radiator system by installing the boiler tube below the ceiling of the boiler. The air that accumulates at the top of the boiler passes around the outside of the tube and flows into the expansion tank.

Any air which might escape by the tube is collected in an air chamber. A circulator in the air chamber creates a turbulence in the water which releases the air. The air is then vented as it collects.

**More information? Circle Item 57 on postcard, page 130.**

## Industrial Man Cooler Fans

A man cooler fan, Model M-24, which mounts anywhere and delivers 5600 cfm with its 24-in. Torrington fan blades is announced by McLean Engineering, Princeton, N. J. Designed for comfort cooling in industrial plants, the fan, when hung from ceiling girders or rafters, provides air circulation along industrial production lines.



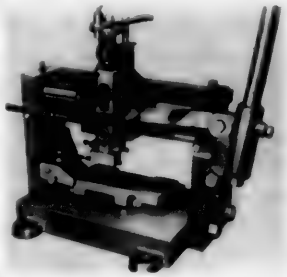
All moving parts of the fan are rubber isolated from the flexible frame and the steel case. Safety guards are provided both front and rear. Other features of the fan include a rubber-mounted, ball-bearing fan shaft, automatic belt tension for elimination of slippage and motor bearing wear, and a choice of either sleeve or ball-bearing 1/3-hp motors.

Tested before shipment, the fans are guaranteed for five years and the motors for one year. While 115v, 60-cycle motors are supplied as standard, other voltages and types may be ordered.

More information? Circle Item 58 on postcard, page 130.

## Bench Marking Machine

A bench marking machine which can be tooled for either round or flat work is available from Pryor Steel Stamps, Chicago, Ill. It is shown in the photograph with a straight type holder for marking round work.



With a capacity for work up to 3 in. in diameter, the fixture is composed of a spindle, mounted on ball bearings, the end of which is recessed 1-5/8 in. in diameter and 1/8 in. deep for fitting adaptors. The standard model is not fitted with a spring return, although many other sizes are available complete with this feature should it be required.

More information? Circle Item 59 on postcard, page 130.

## Line of Small Gearmotors

A line of small gearmotors is announced by Doerr Electric Corp., Cedarburg, Wis.

The motors are made with a NEMA 42 frame and offered in 1/20 and 1/12-hp ratings. Eight standard ratios in the range from 5:1 to 60:1 are offered. The motors can be split phase, capacitor start-induction run, capacitor start-capacitor run, or polyphase and are available with either open or totally-enclosed construction. Pre-lubricated ball bearings are used in the motors.

The gear box can be mounted in a number of positions. One application uses a totally-enclosed, single phase motor with a stainless steel, threaded output shaft to drive an agitator on bulk milk cooling tanks. Provisions are made for grease seals at the input and output shafts.

More information? Circle Item 60 on postcard, page 130.

## Level Device Measures Pitch

A level attachment which converts a level into an inclinometer for establishing and checking pitch, slope, or fall is made by Carr Mfg. Co., Ionia, Mich.

Designed for use on sewer lines, cement drives, checking an existing grade, steam lines, and construction jobs, the device has a basic scale on the calibrated end that consists of two different scales, one for 3-ft levels and the other for 4-ft levels. From the two scales, measurements can be found for any length level.

For example, to obtain a slope of 1 in. per 10 ft on a sewer line, using a 4-ft level, the calibrated dial on the device is turned eight complete turns (one complete turn is equal to a 1/8-in. fall in 10 ft). By placing the level on the sewer line and reading the bubble at the level mark, a 1-in. fall in 10 ft will be obtained. If it does not read level, the sewer tile must either be raised or lowered.

More information? Circle Item 61 on postcard, page 130.

## Solvent Welding Fittings

Solvent welding pipe fittings and flanges are being made of injection molded, unplasticized polyvinyl chloride by Tube Turns Plastics, Inc., Louisville, Ky.

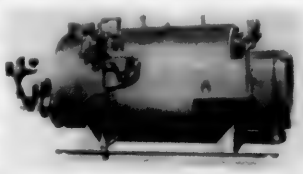
The solvent welding fittings are in addition to the company's line of threaded fittings. Both lines include 90 and 45 deg elbows, tees, unions, couplings, caps, reducing bushings, and flanges.

Solvent welding fittings are recommended where installations are of a permanent nature. The threaded type is recommended where disassembly, revamping or revising of the systems may be required.

More information? Circle Item 62 on postcard, page 130.

## Commercial Water Heater

A tankless, heavy-duty hot water boiler has been developed by Mund Boilers, Inc., Los Angeles, Calif. Known as model LPS, the unit operates with automatic controls.



Designed to provide large quantities of hot water on short notice, the boiler may be used either as an originating or booster heater and will deliver hot water at any temperature up to 200 deg F. Heat transfer is effected in it by a copper heat exchanger. It has Fiberglas insulation and a steel cabinet.

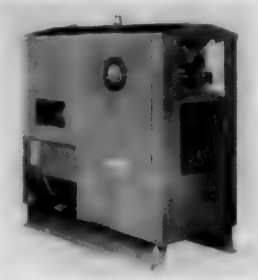
Nine models are available, ranging in capacity from 250 to 1000 gph and 15 to 80 gpm for short periods. The units may be gas- or oil-fired. Combination steam and hot water models are also available.

The boiler is packaged for installation in automatic and commercial laundries, motels, hotels, apartments, restaurants, factories, and institutions.

More information? Circle Item 63 on postcard, page 130.

## Generator-Type Welders

Gasoline engine driven, generator-type welders are announced by Westinghouse Electric Corp., Pittsburgh, Pa. Available in current ranges of 30 to 350 amp, a-c or d-c, the welders are self-powered and can be equipped with optional running gear.



One d-c model is a dual purpose unit which handles d-c welding and can also be converted into an a-c power plant by a conversion switch. The a-c model has a 110-v d-c outlet for operating universal drills and lights. Another model is equipped with high frequency so that it can be used for Heliarc inert gas welding.

The gasoline engine is an air-cooled, 4-cylinder, 20-hp Onan model CW. It has electric starting and an internal fly-ball governor with a variable-speed control attachment.

**More information? Circle Item 64 on postcard, page 130.**

## Fork Lift Rotates Tiles

Cement roof tile handling can be accomplished through the use of a full-circle rotating, hydraulic clamp designed by The Yale & Towne Mfg. Co., Philadelphia, Pa., as an attachment for its standard industrial lift trucks.

When placed on a standard 6000 lb. load capacity industrial lift truck, the clamp can pick up a 3500-lb. load of cement tile or similar material at a 24-in. load center between its fixed forks and hydraulically operated clamp blades. The tiles can be rotated through a 360-deg circle at any point in the vertical travel of the forks to suit storage or loading requirements. The facings of both forks and clamps are fitted with a rubber and plastic cover to insure a tight grip and prevent damage to the load.

In any position around its full circle of rotation the clamp can be opened to a distance of 41 in. from the fork facings. The minimum distance to which the clamp can be closed is 17 in.

**More information? Circle Item 65 on postcard, page 130.**

## Line Coupling

A coupling that can be used for high pressure, gravity flow, or vacuum applications is being produced by Snap-Tite, Inc., Union City, Pa. When equipped with valves, the coupling, designated E, will provide line shutoff.

In small sizes, the coupling holds vacuums in the micron range in both connected and disconnected positions. A packer provides the seal when the coupling is connected, and barrel springs hold the valves closed when the coupling is disconnected.

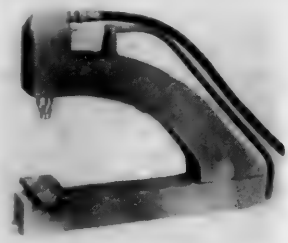
Available without valves, if desired, the coupling is furnished in alloy steel, brass, aluminum, and stainless steel. Cadmium plating is the standard finish, but a variety of finishes are available to specification. The coupling is stocked by the company and its distributors in sizes from ⅛ to 3 in. ID; sizes to 10 in. are available on order.

Bulletin No. 250 contains more information on the coupling

**More information? Circle Item 66 on postcard, page 130.**

## Pneumatic Impact Machine

A machine that delivers up to 200 strokes per minute for jobs that require impact or squeezing is available from Jet-Heet, Inc., Pneumatic Tool Div., Englewood, N. J.



Called Air Champ, the machine staples, eyelets stakes, swages, crimps, stamps, marks, cuts, and clamps. The purchase price of the machine includes a valve, a bolster plate, and a foot treadle that are ready to mount and use. The machine weighs 12 lb and has a 10-in. throat.

A ½-hp compressor, furnishing 1½ cfm of air, can operate 8 machines, each delivering a working stroke every second.

**More information? Circle Item 67 on postcard, page 130.**

## Lightweight Gas Fittings

A line of lightweight, carbon steel, welding fittings for gas distribution systems is introduced by Tube Turns, Div. of National Cylinder Gas Co., Louisville, Ky. They are designed to be employed with the lightweight piping being made by several of the larger mills.

The fittings are being produced in 3 through 24-in. sizes, and in wall thicknesses that permit them to be joined with lightweight piping of the dimensions being manufactured.

**More information? Circle Item 68 on postcard, page 130.**

## 6-Piece Combustion Chamber

A combustion chamber to help servicemen save installation time has been developed by Kolb Refractories Co., Philadelphia, Pa.

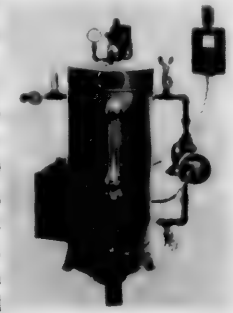
Called the Nu Standard Kolbkast, the chamber has a tongue-and-groove design which prevents the escape of gases. Its base is recessed ¼ in. at the bottom, giving an air space that provides insulation to the floor. Its insulating qualities are equal to insulating brick.

The chamber comes in six pieces: four equal wall segments and two recessed base pieces. Two galvanized steel bands are placed around the chamber after installation to make the assembly air tight. It is available in five sizes and is packed to prevent breakage during shipment.

**More information? Circle Item 69 on postcard, page 130.**

## Larger Boilers Are Offered

Larger capacity models of the Hot Shot electric steam boiler are introduced by Automatic Steam Products Corp., New York, N. Y., thereby making eight different size models available.



The boilers are portable and range in capacity from 3 to 36 kw, or from 1/3 to 4 hp. They attain full pressure in about 20 minutes and have ASME Code, steel jacketed construction, rock wool insulation and UL approval.

The boilers come complete with magnetic contactor and switch and low-water cutoff for protection against water failure. Some of their uses are for industry, laboratories, food processors, hotels, institutions, bakeries, or wherever high or low pressure steam is needed.

More information? Circle Item 70 on postcard, page 130.

## Small De-Aerating Heater

A small size de-aerating heater has been designed for use in small plants by Graver Water Conditioning Co., New York, N. Y.

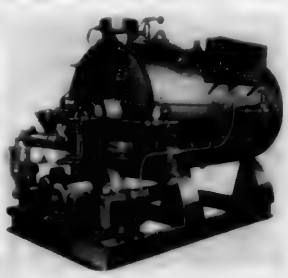
Named the SSC, the heater, while heating the feedwater to the temperature of the operating steam, removes non-condensable gases, such as oxygen and carbon dioxide in boiler feedwater. Since steam is used in the de-aeration process, plants can utilize exhaust steam or reduced pressure make-up steam for this purpose.

Made in a variety of sizes, the heater is a two-stage, spray-type heater containing an internal vent condenser of stainless steel. It is equipped with its accessories and can be combined with a low NPSH boiler feedwater pump to reduce its elevation.

More information? Circle Item 71 on postcard, page 130.

## 50-Hp Boiler Burns No. 4 Oil

A 50-hp steam generator designed to burn No. 4 oil has been developed by Cyclotherm Div., National-U. S. Radiator Corp., Oswego, N. Y. The unit makes it possible for manufacturers with limited space facilities to cut fuel costs, due to the price differential between No. 4 residual oil and light oils. It operates at efficiencies of 80 per cent or better.



The boiler can be installed in 20 sq ft of floor area and requires 4 ft 8¼ in. of head room. Since no cement foundation is necessary to install the boiler, it can be installed anywhere fuel, water, and electricity are available.

Because of its size, the boiler is adaptable for plants where space is limited, or to replace older, larger boilers of lower capacity without structural changes to the plant.

More information? Circle Item 72 on postcard, page 130.

## Four-Inch Pipe Fitting

A fitting for use with 4-in. L-M Perma-Line pipe is offered by Line Material Co., Milwaukee, Wis. The short-radius 45-deg bend is made of a lightweight composition material.

The characteristics of the fitting are consistent with those of the bituminized fiber pipe for which it was designed. Both resist the absorption of water and chemicals, such as organic acids, alkalis, inorganic salts, organic materials, and wastes.

A leak-proof seal developed between the fitting and pipe will withstand static pressure exceeding the specifications of Commercial Standards CS116-54.

More information? Circle Item 73 on postcard, page 130.

## 2-Hp Room Cooler

A flush-mounted, 2-hp, room air conditioner, Model M-3005, is placed on the market by Mitchell Mfg. Co., Chicago, Ill.

The air conditioner is designed for use in rooms from 1000 to 1300 sq ft in floor space. It is being added to the company's Super High Capacity line, which also has units of ¾, 1, and 1½ hp. All the units have the same cabinet size and are interchangeable.

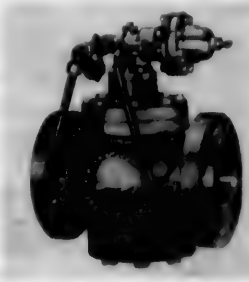
Like the company's other 1955 units, the 2-hp model is engineered to comply with the new ARI-EEI-NEMA joint recommendation which provides that, starting in 1956, room air conditioners of ¾ hp and up have power factors not less than 85 per cent. The rated power factor at UL's conditions for the 2-hp unit is 93 per cent.

More information? Circle Item 74 on postcard, page 130.

## Valve Has Adjustable Range

A single-seat, pilot operated control valve, the Type 10, is being produced with an adjustable throttling range by A. W. Cash Co., Decatur, Ill.

By switching the control piping, the valve can be converted from a pressure reducing and regulating valve to a back pressure control valve. A dial-type range selector is used to select the throttling range necessary for the particular process application involved.



The valve can be used with water, gas, air, light oils, and refrigerant. It is recommended for water systems, altitude control, as an unloading valve, and for back pressure control.

Made of iron, bronze, or steel, the valve is available in sizes from 2 to 12 in. with flanged ends and from 2 to 3 in. with screwed ends.

More information? Circle Item 75 on postcard, page 130.

## Pocket Gas Indicator

An explosive gas indicator, slightly larger than a fountain pen and called the Page Sensor pocket model is introduced jointly by Hogart Engineering Co.. Los Angeles, Calif., and Davis Emergency Equipment Co., Inc., Newark, N. J.

It is intended for use where a spot check for combustible gases or vapors is needed, and it operates on 2 small penlight batteries.

To use it, the operator removes the indicator from its plastic case and depresses the light bulb, which acts as a switch. When the switch is on, the bulb glows dimly. If there is a trace of combustible gas or vapor in the atmosphere, the light begins to flash intermittently. As the concentration of combustibles increases, the flashing becomes more rapidly until a steady, bright light indicates the atmosphere is hazardous.

The indicator can be tested in the absence of combustible gases, and the batteries can be replaced when needed.

**More information? Circle Item 76 on postcard, page 130.**

## Meter Measures Entire pH Range

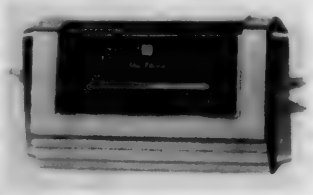
A meter, Model 110, which covers the entire pH range from 0 to 14 is announced by Photovolt Corp.. New York, N. Y. With a scale length of 7 in., the meter will cover the pH range without switching and without a reversal of the pointer's travel.

The instrument can be furnished in a portable model with a baseboard and carrying cover. The accessories available with the meter include a swing-arm adapter for immersing the electrodes by tilting motion and a shielding hood for use with unshielded electrodes.

**More information? Circle Item 77 on postcard, page 130.**

## Year-Round Thermostats

Control of summer air conditioning and winter heating can be obtained with the Duo-Classic thermostat announced by Detroit Controls Corp., Detroit, Mich.



Heating, cooling, and air circulation are controlled by a single switch on the thermostat. Less expensive installation and simplified operation can be had from it when it is used with the company's universal control panel for combination heating and cooling systems. It will hold the selected temperature to within a fraction of a degree, reducing the waste of over-heating and under-heating.

The thermostat's satin-gold case is complemented by a black dial, and its design is intended to blend with any period of interior furnishings. The numerals and graduations are set against a satin black face.

**More information? Circle Item 78 on postcard, page 130.**

## Device Cleans Home Water

A device for clearing rusty, discolored water from city supply or domestic well systems has been developed by Filtrine Mfg. Co., Brooklyn, N. Y. Patterned after heavy-duty water conditioning equipment, the device, called Rust-Master, can be installed in residential or plant plumbing systems.

Operating at low pressure without restricting flow, the unit provides clean water for drinking and laundering and protects washing machines, heaters and other home appliances from clogging and corroding. Where chlorine and sulphur tastes occur, it can be installed with the company's Taste-Master units to remove the tastes and odors.

The unit occupies no more space than a water meter and can be maintained without the use of tools. It is sold with a five-year guarantee.

**More information? Circle Item 79 on postcard, page 130.**

## Three Strokes Lift 4 Inches

A hand truck modified to suit the needs of a worker handling light loads is available from The Yale & Towne Mfg. Co., Philadelphia, Pa.

Built to take loads up to 1,000 lb, the truck has faster lifting speeds with its 4-in. hydraulic lift being achieved by three lifting strokes. Pallet load movings can be facilitated by this lifting speed.

In outward design the truck resembles the company's present H20P model of 27-in. fork width and 48-in. fork length. It is constructed to handle either single or double faced pallets.

**More information? Circle Item 80 on postcard, page 130.**

## Self-Propelled Concrete Saw

A self-propelled concrete saw, the Target Model 360, with speeds that are adjustable while the saw is in motion is manufactured by Robert G. Evans Co., Kansas City, Mo.

Powered by a 36-hp, 4-cylinder engine, the saw has forward speeds from 1 to 25 ft per min that are under the control of the operator while the saw is moving. The operator can also control the cutting speed of the blade and its depth while the saw is moving. A revolving pointer, with an indicator for 12, 14, and 18-in. blades, visually records the sawing depth as the blade is hydraulically lowered or raised.

A water pump flushes the sludge out of the cut to maintain the cutting speed.

**More information? Circle Item 81 on postcard, page 130.**

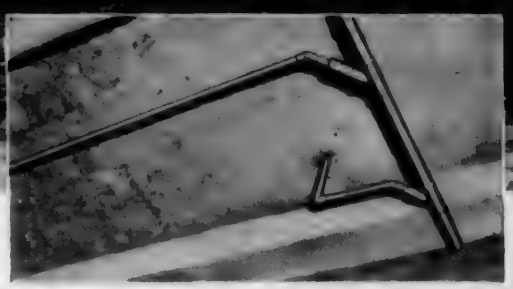
(*Concluded on page* 128)

*Architects:* SHEPLEY, BULFINCH, RICHARDSON & ABBOTT and SMITH & SELLEW, Boston
*Gen. Cont.:* B. PERINI & SONS, Framingham, Mass.
*Plumb. Cont.:* C. H. CRONIN, Boston
*Revere Dist.:* CHARLES D. SHEEHY, INC., Boston

Boasting of ramps and half-flights of stairs, multi-unit construction for easy expandability and similar innovations, this $3,500,000 school is one of the most modern layouts in the country. Yet, its plumbing lines are being serviced by man's oldest metal . . . copper!

Although copper is man's oldest metal, it also is his newest. For it will help keep this school young as it has been keeping other buildings young for scores of centuries. Its enduring qualities outperform all other materials in water line service, while the many advantages of working with copper water tube, contractors tell us, make it easier, less costly, to install. There are fewer joints with Revere Copper Water Tube, and the joints that are necessary are made in a jiffy with fewer tools. They're tight, leak-free ones, too. And maintenance, a mighty important item in schools and similar buildings, is practically nil with non-rusting copper water tube on the job.

Keep out of trouble with copper. Use Revere Copper Water Tube for radiant panel heating, hot and cold water lines, underground service lines, processing lines, waste lines and vent stacks. See your Revere Distributor for your needs. And if you have technical problems involving the best way to use Revere Copper Water Tube, one of our Technical Advisors will be glad to help.



**23,969 LBS. of REVERE COPPER WATER TUBE** were used for the plumbing lines in the Natick Senior High School, in sizes from ½" to 5". Installation would have been slower, more costly, if threaded pipe had been used in the close quarters shown in photo above. There are no wrench-room worries when you use Revere Copper Water Tube and solder fittings.

**WITH NON-RUSTING** Revere Copper Water Tube on the job there is no loss of flow or pressure, no allowance in pipe size required as would be the case with rustable pipe.

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*Sales Offices in Principal Cities, Distributors Everywhere*

(Continued from page 126)

## Electric Low-Water Cutoff

An electric, low-water cutoff, called Electro-Larm, is announced by Econo Products Co., East Haddam, Conn.

Different in operation and construction from the mechanical float-type, the cutoff protects a boiler employing no moving parts to fail, clog, or jam. Operating electrically and using a porcelain electric probe recorder, the principle of the cutoff is an adaptation of that used in industrial, liquid level controls.

A porcelain probe is mounted through a tapping in the boiler and signals if water level falls by lighting a red signal light and sounding an audible alarm in the alarm box. The unit is designed with a built-in timing device which prevents signals from being sounded by boiler surges or other momentary water level variations.

One size of the unit will accommodate any boiler.

**More information? Circle Item 82 on postcard, page 130.**

## 600-Hp Water Chillers

Water chillers, called Centravac, are available with refrigeration capacities up to 800 tons from The Trane Co., La Crosse, Wis. The chillers are powered by 600-hp squirrel-cage motors which are hermetically sealed.

Similar to previous models, the chillers can be used for part load operation down to 10% of full load.

**More information? Circle Item 83 on postcard, page 130.**

## Pilot Has Other Uses

A non-aerated pilot burner, the Mini-Pilot, originally developed for use on gas ranges, has been adapted to other gas appliances by Grayson Controls Div., Robertshaw-Fulton Controls Co., Lynwood, Calif. The device has been field-tested on water heaters and clothes dryers.

Flame retention stability is achieved for the burner by a baffle element that holds the flame to the port.

Because it is non-aerated, the burner is free from difficulties due to linting. It burns with a blue flame on all gases and normal pressures. The burner can be applied to most of the gas appliances which require automatic safety pilots.

A similar type of pilot burner has been developed by the company for those applications where a higher Btu per hr input rating is desired.

**More information? Circle Item 84 on postcard, page 130.**

## Aluminum Tubing

Aluminum specialty tubing is available in a range of shapes and sizes from Harvey Aluminum, Torrance, Calif.

Made of 6066 alloy, the tubing possesses resistance to the general corrosive conditions encountered in many applications. It is being made square, rectangular, in special configurations, and in the conventional round form.

The tubing is recommended for water heaters, condensers, unit heaters, air lines, pumps, and water lines.

**More information? Circle Item 85 on postcard, page 130.**

## Pulley for Variable Speeds

A ¾-hp, variable speed pulley, which can be adapted to new or old equipment, has been developed by Lovejoy Flexible Coupling Co., Chicago, Ill.

The pulley delivers a speed ratio of 2¾ to 1, using an A-section belt. Its maximum bore is ⅞ in. with a keyway. The shaft bore runs through the entire length of the pulley, giving it the advantage of reverse mounting when necessary on special installations.

A spring cover is not used on the pulley because in the majority of cases the pulley is used in the enclosed portion of the machinery. The entire unit measures 4-13/16 in. in over-all length and 6 in. in diameter. Its weight is 6½ lb.

**More information? Circle Item 86 on postcard, page 130.**

## Bender Dies Are Introduced

Six bender dies for maintenance and production work are introduced by Hossfeld Mfg. Co., Winona, Minn.

The six dies introduced by the company are as follows: the Bulldozer die for making round or square bends on flatstock; the Edgebend die, two to a set, for bending flatstock edgeways; OD steel tubing dies for bending 1¼ to 24-in. radii; pipe dies for making close return bends on pipe with radii from 1¼ to 36-in.; 90-deg conduit dies for bending standard pipe and rigid conduit; and thin wall electrical metallic conduit dies that require no mandrel.

The company's No. 2 iron bender is illustrated in the photograph.

**More information? Circle Item 87 on postcard, page 130.**

### Manufacturers' Representative

If you are seeking new lines, we suggest you register your name, territory covered, and present lines with this publication. We get numerous requests from manufacturers seeking representatives and by registering you pave the way to lining up desirable accounts. Write to the Editor, AIR CONDITIONING, HEATING AND VENTILATING, 93 Worth St., New York 13, N. Y.

# PRODUCT INFORMATION SERVICE

**Use the postage-free postcard below for further information on:**

- **News of Equipment and Materials**

**or a copy of the following**

- **New Catalogs**

**Circle the item Numbers in which you are interested and print clearly your name and address with title.**

## NEW CATALOGS

**ELECTRONIC CONTROLS MANUAL**—A reference guide on electronic controls of heating, ventilating, and air conditioning is published by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. The booklet is designed to provide engineers, architects, and their specification writers with an up-to-date reference on available electronic equipment and components, typical system specifications and connection diagrams, and data sheets on control panels for a wide variety of building installations. .....Item 106

**PIPE INSULATION BROCHURE**—A 2-page, 2-color, product data brochure describing Fiberglas white, dual temperature, pipe insulation is offered by Owens-Corning Fiberglas Corp., Toledo, Ohio. The publication includes five photographs, a graph, and a thickness table. .....Item 108

**BULLETIN ON PACKAGED COOLERS**—An illustrated bulletin, No. C-1160-B64, on packaged air conditioning applications in various fields is issued by Worthington Corp., Harrison, N. J. The bulletin photographically illustrates packaged unit applications and installations in savings and loan associations, restaurants, optical manufacturers, soda shops, institutions, and association headquarters. ...Item 105

**SHEAVE BULLETIN IS RELEASED**—Stationary and motion control sheaves for speed variations by means of pitch diameter adjustment, are described in a bulletin, No. 20B6062C, released by Allis-Chalmers Mfg. Co., Milwaukee, Wis. Included in the bulletin is a table of sizes and general dimensions of Vari-Pitch sheaves and a table of general dimensions of Paraline ball bearing motor bases, which are designed for use with the motion control sheaves. .....Item 104

**FLOOR-TYPE COOLER BULLETIN**—An illustrated bulletin, Form 5123, describing self-contained, floor-type air conditioners for commercial class installations is available from American Blower Corp., Detroit, Mich. The bulletin discusses the construction, operation, and maintenance of five air conditioners. A selection table is included which lists data covering cabinet dimensions, specifications for compressors, fans and filters, nominal conditioner capacity, and cfm ratings .....Item 103

**BASEBOARD INSTALLATION FILM**—Design for Comfort is the title of a 40-minute sound motion picture, in full color, produced by Warren Webster & Co., Camden, N. J. The movie, which demonstrates the step-by-step installation of a baseboard heating system, was filmed in a home under construction. Close-up views pinpoint numerous tricks-of-the-trade to help heating contractors do a thorough installation job with minimum man-hours. Interested organizations are invited to arrange for a showing of the film. .....Item 108

**BULLETIN DESCRIBES TANK GAGE**—An 8-page bulletin, No. 6004, describing a line of remote-reading, industrial liquid depth gages, is available from Liquidepth Indicators, Inc., Long Island City, N. Y. The bulletin presents information on the operation and design of the Petrometer Series 1600 gages, as well as on the method of selecting the right gage. .....Item 107

**FLEXIBLE HOSE BULLETINS**—A set of bulletins, Nos. 40, 41, 42, 43, and 44, and prices of flexible hose are offered by The Flexaust Co., New York, N. Y. The bulletins are intended for those who design, install, or purchase flexible hose for dust and fume control or air conditioning. They contain general information, accessories, installation, application, friction loss, and other useful data. .....Item 102

**PIPING COSTS ARE DISCUSSED**—A yardstick for measuring basic cost factors in the installation of piping systems is contained in an 8-page, illustrated booklet published by A. M. Byers Co., Pittsburgh, Pa. The publication, entitled True Piping Economy, compares wrought iron and other types of pipe in terms of the three important costs to consider in buying pipe: initial purchase cost, cost of installation, and cost of maintenance. In the contents of the booklet are several case histories of piping installations. A digest of the important uses for wrought iron pipe in different types of industrial and municipal services is also included. .....Item 109

**HEATING A FRUIT TERMINAL**—How oil-fired, warm air space heaters were put to use in designing a heating system for a large receiving and shipping terminal is described in case study No. 550-70, published by Drave Corp., Pittsburgh, Pa. The study explains how the positioning and air throw of the units enabled the designers to provide protection for tender fruit against freezing, and how it was done without interfering with transfer operations. .....Item 110

**PIPE AND TUBE BROCHURE**—A 16-page, illustrated brochure describing various types of copper and brass pipe and tube is published by Phelps Dodge Copper Products Corp., New York, N. Y. The brochure lists the dimensions, weights, and specifications of copper water tube, copper drainage tube, red brass and copper pipe, refrigeration tube, threadless pipe, and other tubular products. .....Item 111

**AUTOMATIC CONTROLS BULLETIN**—An automatic control system bulletin, No. S-10, is available from Automatic Temperature Control Co., Inc., Philadelphia, Pa. It describes how the company can assist in arriving at the right application of an automatic control system. Case histories are presented by the bulletin along with a description of the scope of the company's services in the phases of design, purchasing, construction, and start-up of its packaged automatic control systems. .....Item 113

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READERS' SERVICE DEPT.

**FIN TUBE RADIATION RATINGS**—Fin pipe and baseboard radiation are described in a 16-page catalog available from Stadco Products, Wilkes-Barre, Pa. The catalog contains information and IBR Ratings on 23 capacities of steel, aluminum, and copper fin tube radiation. Photographs and dimensional drawings of single, double, and triple tier enclosures are given for each of the seven models of enclosures in the catalog. .....Item 114

**CARRIER-FITTING CATALOG** — A carrier-fitting selection catalog, containing the information necessary to select the correct carrier-fitting for mechanical or architectural conditions, is published by Wade Mfg. Co., Elgin, Ill. The catalog includes scale drawings of recommended and minimum required pipe space dimensions, photos of the various types, and a check list showing each available variation for different fixtures. .....Item 114

**DEHUMIDIFICATION BULLETIN**—An 8-page bulletin, entitled Dehumidification of Compressed Air and Gases, is printed by Desomatic Products, Inc., Falls Church, Va. The bulletin has some illustrations showing refrigeration and adsorption-type equipment for the dehumidification of compressed air and gases. .....Item 116

**FINNED-TUBE RATINGS**—A 32-page bulletin, No. 1000, describing Sarcodin finned-tube radiation and including IBR ratings is available from Sarco Co., Inc., New York, N. Y. A 4-page bulletin, No. 1025, is also available from the company describing baseboard systems. .....Item 116

**BOILER SAFETY BOOKLET**—A 2-color booklet on safety devices for hot water space heating boilers is issued by McDonnell & Miller, Inc., Chicago, Ill. The booklet consists essentially of illustrations of one typical hot water space heating boiler with colors employed to detail the operating conditions. .....Item 117

**CATALOG OF VENTILATING FANS**—The complete line of Rex-Airate ventilating fans for 1955 is shown in a 14-page, 2-color catalog available from Air Controls, Inc., Cleveland, Ohio. The catalog shows seven different models for domestic, commercial, and industrial use, both belt- and direct-driven. It contains specifications and tables for calculating the number and size of fans needed for a given space, as well as the time required for a complete change of air in various types of installations. In addition to the catalog, three new pieces of sales literature for consumer use are ready for dealers to aid promotional efforts. .....Item 118

**PIPE CUTTING BULLETIN**—A 4-page, 2-color bulletin on the Speed-Cut abrasive cutting machine is released by Beaver Pipe Tools, Inc., Warren, Ohio. Featuring both the No. 14 bench-type and No. 20 floor-type models, the bulletin gives data on the length of cutting time required for various shapes and types of materials. The back page of the bulletin is devoted to specifications and prices. .....Item 119

**FLEXIBLE HOSE LITERATURE**—A 2-color, 12-page, illustrated catalog, No. 147, on all types of Flexen flexible metal hose is released by Flexonics Corp., Maywood, Ill. The catalog covers the full range of the company's Rex-Weld corrugated metal hose, Rex-Tube convoluted hose, Rex-Flex stainless steel flexible metal hose, and numerous special purpose assemblies. Complete coupling data is also included. Featured in the catalog, is a 4-step guide for the selection of flexible metal hose to meet particular requirements. .....Item 120

**85% MAGNESIA MANUAL**—A second edition of the 85% Magnesia Insulation Manual is available from The Magnesia Insulation Manufacturers Association, Washington, D. C. In this second edition of the manual, the contents of the 1949 edition have been brought up to date. The 74-page, indexed manual is divided into three major sections. The first is a 9-page discussion of 85% magnesia insulation. The second describes application procedures in the insulation of piping and equipment, insulation finishes, and maintenance. The third section of the manual is the appendix, which contains definitions, tables, a glossary of trade terms, and a bibliography. .....Item 121

**CHEMICAL PUMPS DESCRIBED**—Small rotary displacement and centrifugal pumps for chemical service are described and illustrated in a bulletin offered by Eco Engineering Co., Newark, N. J. Among the models detailed in the 4-page folder are the company's standard stainless steel, synthetic rubber, and bronze low-volume pumps with interchangeable Teflon, Hypalon, Neoprene, carbon, or Permico impellers for diverse applications in the processing field. A table of recommended uses, specifications for each unit, and photographs of conventional mountings and drives are also contained.....Item 122

**VALVE CATALOG IS ENLARGED**—An enlarged version of its annual Condensed Refrigeration Valve catalog is released by A-P Controls Corp., Milwaukee, Wis. Increased in size from 12 to 20 pages, the catalog illustrates and describes the company's entire line. The new products issued by the company in 1954 and early 1955 are shown in the catalog along with the valves, filters and driers. .....Item 123

**FOLDER LISTS GLASS SIZES**—A pocket-size, 3½ by 6½-in. folder listing the standard size units of Thermopane insulating glass is available from Libbey-Owens-Ford Glass Co., Toledo, Ohio. The folder was produced to give those who specify, build with, use, and sell the insulating glass a list of its standard sizes to encourage their wider use over non-standard size units. The four-page folders are printed on heavy paperboard. .....Item 124

**NEW CONVERTER CATALOG**—A 12-page catalog describing 2 and 4-pass converters for controlled steam heating of recirculated water in hot water and radiant heating systems is available from Alstrom Corp., New York, N. Y. The catalog gives the specifications and details of heat exchangers, in capacities which range from 48,000 to 4,800,000 Btu per hr at steam pressures from 0 to 30 lb. A page of engineering data explains how to select the proper size converter, and the least expensive unit, for a hot water or radiant heating system. A diagram which illustrates a typical converter hookup is also shown in the catalog, and a dimension table gives measurements and weights for hot water or radiant heat installations. .....Item 125

**BULLETIN ON REMOTE UNITS**—A bulletin, RC-C2, covering remote-type room heating and cooling units is available from Feddors-Quigan Corp., Trenton Div., Trenton, N. J. The bulletin gives capacities and dimensional data on standard sizes for floor-mounted and semi-recessed installations. .....Item 126

**ACCESSORIES CATALOG**—An illustrated catalog, No. R-655, of refrigeration and air conditioning accessories, is available from Madden Brass Products Co., Aurora, Ill. Several new valves, swivel tees, charging lines, and flare fittings are listed in the catalog. A new hermetic 4-in-1 port valve that pierces four tube sizes is also described. .....Item 127

**CONTROLS BULLETIN** — Pressure, hydraulic, temperature, process, and combustion controls are described in a 4-page bulletin published by A. W. Cash Co., Decatur, Ill. The bulletin contains photographs of 37 items in the Cash Standard line. Also included is a brief description of recommended applications, construction and operation features, and range of sizes. .....Item 128

**FIRE DETECTION BULLETIN**—A 7-page bulletin is published by Fireye Div., Electronics Corporation of America, Cambridge, Mass. It contains illustrations, technical data, and power information about two new standard Fireye fire detection systems designed to protect warehouses, large storage or factory areas, churches, theaters, and auditoriums. The bulletin offers guidance on how to specify automatic fire detection systems, including general wiring information, power supply, and a description of the mounting of the control panel units. .....Item 129

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 101 | 110 |
| 2 | 12 | 22 | 32 | 42 | 52 | 62 | 72 | 82 | 102 | 111 |
| 3 | 13 | 23 | 33 | 43 | 53 | 63 | 73 | 83 | 103 | 112 |
| 4 | 14 | 24 | 34 | 44 | 54 | 64 | 74 | 84 | 104 | 113 |
| 5 | 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 105 | 114 |
| 6 | 16 | 26 | 36 | 46 | 56 | 66 | 76 | 86 | 106 | 115 |
| 7 | 17 | 27 | 37 | 47 | 57 | 67 | 77 | 87 | 107 | 116 |
| 8 | 18 | 28 | 38 | 48 | 58 | 68 | 78 | | 108 | 117 |
| 9 | 19 | 29 | 39 | 49 | 59 | 69 | 79 | | 109 | 118 |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | | 110 | 119 |

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# "a lady likes her hot bath **Rust-Free"**

**a p-k cement-lined water heater supplies it *economically***

**for** Elsie

Rust-free hot water is essential for dairy cleaning operations and the Borden Ice Cream Plant in Wilmington, Delaware, gets an abundance of it from a **p-k** cement-lined hot water storage heater.

This 1200 gal. capacity unit provides hot water for the nightly washdown of all the dairy's process equipment. It heats 5400 gph from 40 deg. F. to 180 deg. F., using steam at 100-lb. pressure.

The **p-k** heater is cement-lined to provide clean water for long life and low cost. A cement lining is applied over a tough metal lath welded to a carbon steel shell. Fortifying the outer steel shell against corrosion, it assures an ample supply of rust-free hot water. The heater meets all ASME specifications.

When you need standby hot water for intermittent demand in capacities from 180 to 10,000 gal., a **p-k** cement-lined hot water storage heater is an excellent investment.

*Write for your copy of the* **p-k** *Hot Water Heater Bulletin.*

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# What Would You Do?

## Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

A PROBLEM common to all industrial plants is adequate washing facilities for the men and women employed in the plant. If the proper facilities are not provided, considerable time is lost as employees wait their turn, and state or local codes governing such installations might have been disregarded.

The problem in full that is discussed is stated in the box on this page. Should you have some comments that you would like to add to the coming discussion or if you have a problem that you would like to see discussed in this department, write to the Editor.

### Problem for the Coming Issue

**In making changes in plant operation and the necessary piping for these changes, we became aware that we will not have sufficient lavatories or wash fountains for our employees. Is there some rule or standard used by designers in determining the number of units to install in relation to the number of persons employed?**

### Discussion of the Problem

Requirements for lavatories depend on the number of people employed. In Table 1 is a reasonable basis in arriving at the minimum number of basins required. Above 100, add one wash basin for each additional 15 persons. For employees exposed to infectious or irritating materials, where employees handle unwrapped food or where food products are manufactured, additional lavatories may be required by local code conditions. Lavatories, other than those provided for employees who handle food or are engaged in the manufacture of food, should not be located in the work area.

When rectangular wash troughs are considered, then according to a standard that is recognized by the United States Public Health Service, and the American Standards Association, 24 inches of trough with faucet is equivalent to one lavatory. Personally, I do not recommend this. A specific adherence to the directives of local code requirements is recommended. Individual type lavatories are usually preferred (1) where the work is clean and light (2) where wash and toilet rooms are of the decentralized type and (3) the number of employees is few.

For washing facilities in the large or moderately large industrial type buildings, there is a preference for the trough types for both sanitary reasons and convenience. These types are available in rectangular and circular patterns. Table 2 is commonly used for circular wash fountains, subject to modifications to conform with local code requirements.

Other authorities suggest that a greater number of fixtures be provided for a lesser number of people. It is

(*Concluded on page* 134)

**TABLE 1.—MINIMUM NUMBER OF BASINS REQUIRED**

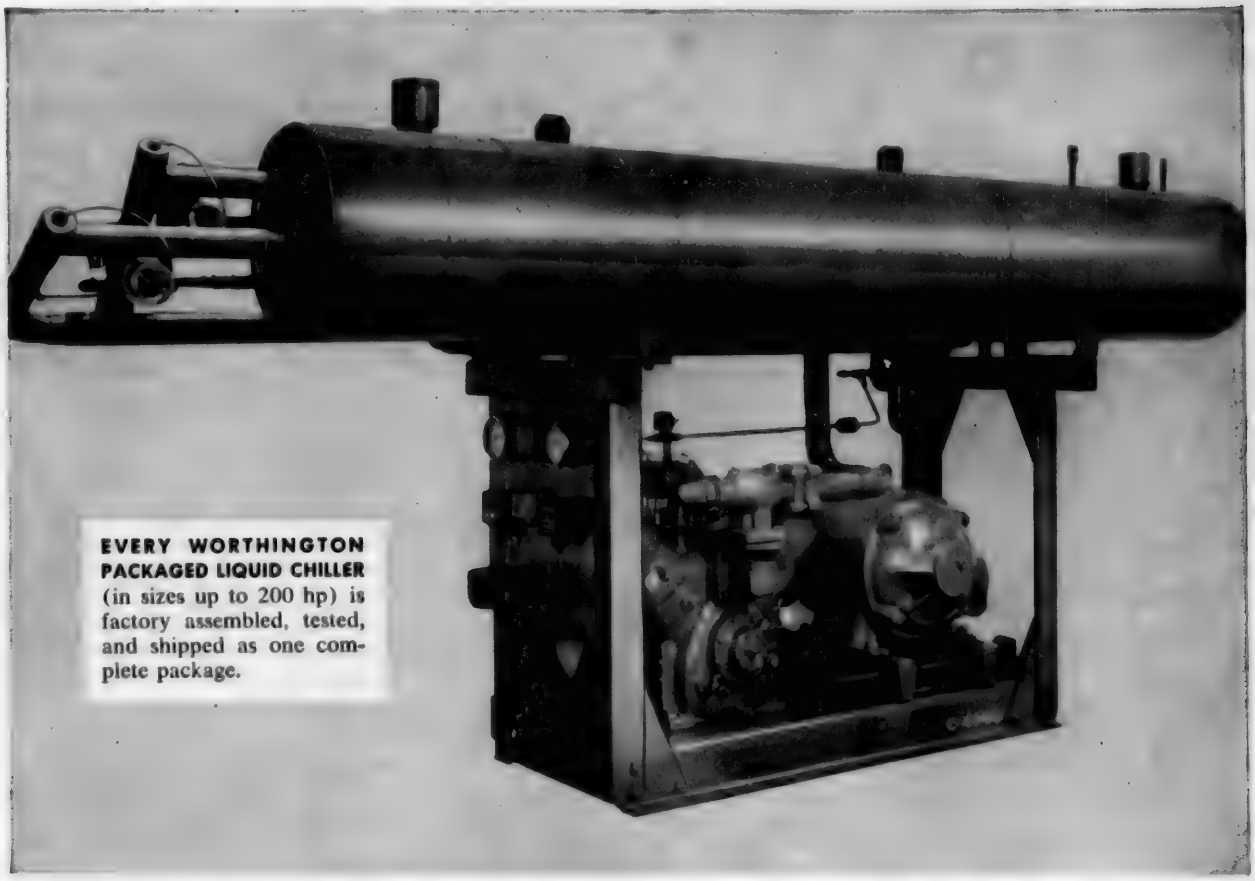
| No. of Persons | No. of Wash Basins |
|---|---|
| 1-10 | 1 |
| 11-20 | 2 |
| 21-30 | 3 |
| 31-40 | 4 |
| 41-50 | 5 |
| 51-60 | 6 |
| 61-70 | 7 |
| 71-80 | 8 |
| 81-90 | 9 |
| 91-100 | 10 |

**TABLE 2.—NUMBER OF PERSONS SERVED BY CIRCULAR WASH FOUNTAINS**

| Number of Fountains | 36" Semi-Circular | 36" Semi-Circular | 54" Semi-Circular | 54" Semi-Circular |
|---|---|---|---|---|
| | Number of Persons Served by Each Unit | | | |
| | 3 | 5 | 4 | 8 |
| | Total Persons Served by Fountains Specified | | | |
| 1 | 1-60 | 1-100 | 1-80 | 1-175 |
| 2 | 61-125 | 101-225 | 81-175 | 176-375 |
| 3 | 126-200 | 226-350 | 176-275 | 376-575 |
| 4 | 201-275 | 351-475 | 273-375 | 576-775 |
| 5 | 276-350 | 476-600 | 376-475 | 776-975 |
| 6 | 351-425 | 601-725 | 476-575 | 976-1,175 |
| 7 | 426-500 | 726-850 | 576-675 | ..... |
| 8 | 501-575 | 851-975 | 676-775 | ..... |
| 9 | 576-650 | 976-1,000 | 776-875 | ..... |
| 10 | 651-725 | ..... | 876-975 | ..... |
| 11 | 726-800 | ..... | 976-1,075 | ..... |
| 12 | 801-875 | ..... | ..... | ..... |
| 13 | 876-950 | ..... | ..... | ..... |
| 14 | 951-1,025 | ..... | ..... | ..... |

### This Month's Problem

**Were I a ventilating engineer, this question would not be asked. But as a new plant engineer, I have been checking on existing dust collecting equipment here as management would like some changes. Are there any rules that govern when one type should be used and not another? What are some of the characteristics of common types?**



**EVERY WORTHINGTON PACKAGED LIQUID CHILLER** (in sizes up to 200 hp) is factory assembled, tested, and shipped as one complete package.

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If you're interested in process cooling, refrigeration, or air conditioning, take a long look at these six big advantages of the new Worthington packaged liquid chillers:

**LOW-COST OPERATION** — Simple variable capacity control exactly matches load requirements — results in unusually economical operation.

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**WIDE SELECTION** — No matter what you want to chill — water or brine — you can get a Worthington packaged liquid chiller that's exactly right for the job. Sizes from 7½ all the way up to 200 hp.

Want more facts? Mail the coupon today for Bulletin C-1100-B52. It tells all about specifications, features, and typical applications. A-5.58

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**Section A-5.58-V**
**Harrison, N. J.**

**Gentlemen:**

Please send me your new Bulletin C-1100-B52 on Worthington Liquid Chillers.

Name_____

Address_____

City_____ Zone____ State_____

(*Concluded from page* 132)

imperative, however, that the minimum number of fixtures be consistent with the requirements of local governing codes.

*Walter C. Knight*
*Executive Engineer*
*New York, N. Y.* *Guy B. Panero*

It is difficult to give a definite answer as there are several factors involved. Some states have a definite figure set up. However, these figures vary considerably. For example, the maximum number of workers per wash fountain bowl or faucet in California is 15 for either men or women, 25 in Connecticut, 50 in Florida, 50 in Kentucky and 30 in Massachusetts. The average would be between 15 and 20. Also the type of business would have some bearing. If employees become extremely dirty, they would require a longer time to wash, and if there are not enough washing facilities available, too long a wash-up time is required.

With washfountains, there is a saving in space and installation costs. One 54 in. unit requires only one hot and cold connection and one drain, and it can accommodate from 8 to 10 persons at one time, with a capacity of 50 persons in an average wash-up period. This is in comparison with 10 individual lavatories with all the extra plumbing and maintainance.

*C. H. Berenger*
*Milwaukee, Wis.* *Bradley Washfountain Co.*

I would first advise consultation with the State Labor Commission on their requirements. If the state has no requirements, it is possible that the city or municipality might enter the picture, and if these governing bodies have no requirements, the American Standard Safety Code for Industrial Sanitation in Manufacturing Establishments (ASA 24.1-1935) could be used as a guide. This is contained in a report of the Coordinating Committee for a National Plumbing Code that was issued back in 1951.

*John C. Zack*
*New York, N. Y.* *Chapman, Evans & Delehanty*

## Air Conditioning Increases Plant Production

Many industrial firms considering the installation of air conditioning or weighing the value of air conditioning will find of interest the experience of John Hardy & Son, Inc., Pulaski, Tennessee, manufacturer of ladies' full-fashion nylon hosiery.

John Hardy, Sr., president, reports a 29% increase in production after installing air conditioning. On a Monday preceding the completion of the plant's air conditioning and humidity control system, girls in the seaming department seamed 225 dozen pair of hose. On the following Monday when the new system was in operation, the same operators, working the same number of hours with the same machines, seamed 444 dozen pair.

The company states that it has been able to reduce the length of its workday and to eliminate Saturday and other overtime work. Because of increased production, employees can keep up with long rows of delicate 54 gage knitting machines in the shorter period.

Another big saving, according to Mr. Hardy, has resulted from the fact that with air conditioning, machinery requires less maintenance. Knitting machines are 57 ft long and the needles have only .002 of an inch clearance. A 3 degree variation in temperature and 3% variation in humidity will cause expansion and contraction to the point of causing the machines to jam.

Prior to air conditioning, it was necessary that a maintenance man be available full time on all three shifts, constantly adjusting the machines. Since the air conditioning and humidity system has been in operation, maintenance cost has dropped approximately 80%.

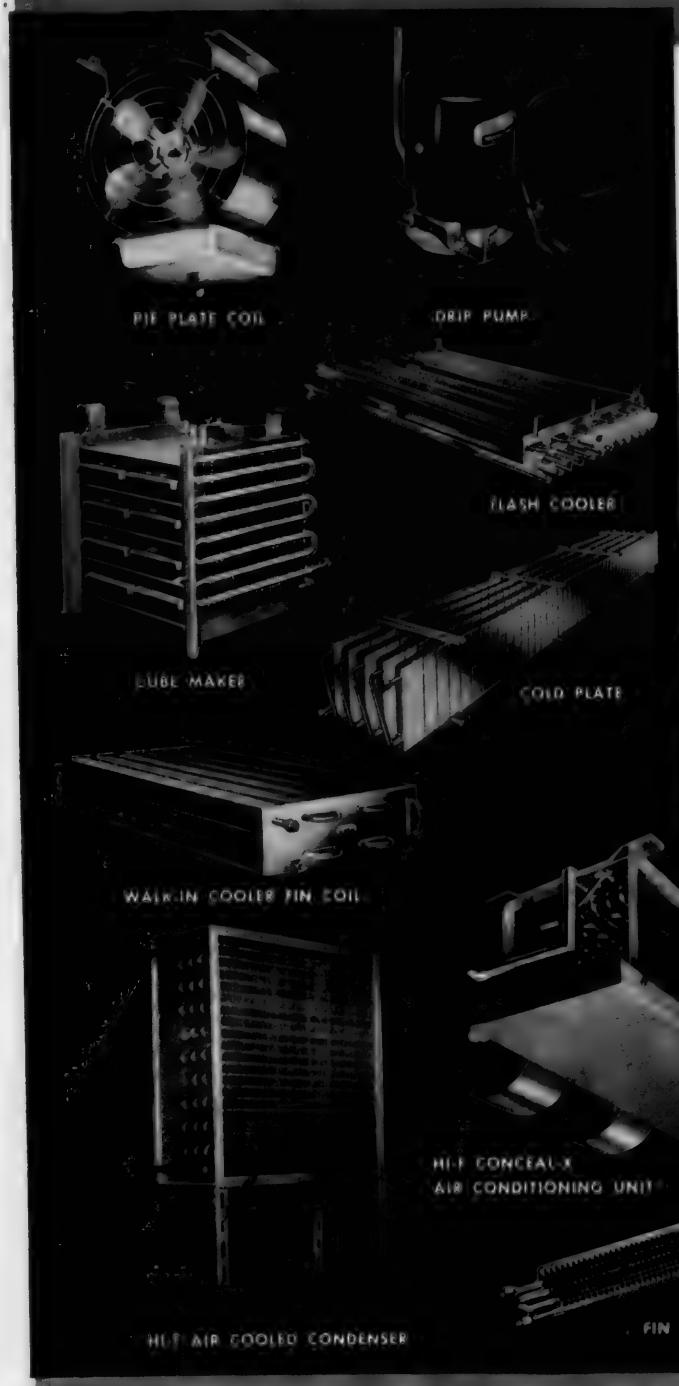
In addition, Mr. Hardy advises that a semi-annual cleaning of the machines is no longer necessary due to the cleaner, filtered air provided by air conditioning.

The hosiery plant's air conditioning system consists of four Chrysler Airtemp 15-ton packaged water-cooled units tied into two duct systems that extend the entire length of the factory. The same ductwork is also used for heating. Two of the air conditioners—one on each duct system are controlled by both a thermostat and a humidistat to permit removal of moisture during in-between seasons. Re-heat is used to control temperature under these conditions. Moisture is added in winter.

Long rows of delicate knitting machines required constant maintenance before air conditioning was installed.

Three of the four 15-ton packaged air conditioners installed in the hosiery knitting plant.

# THE COMPLETE PEERLESS LINE
## FAMOUS FOR
# BUILT-IN SATISFACTION

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# PEERLESS OF AMERICA, INC.

MANUFACTURERS OF REFRIGERATION AND AIR CONDITIONING COILS SINCE 1912

Dept. A, 5620 N. PULASKI ROAD, CHICAGO 30, ILL., U.S.A.

# PRODUCT APPLICATIONS

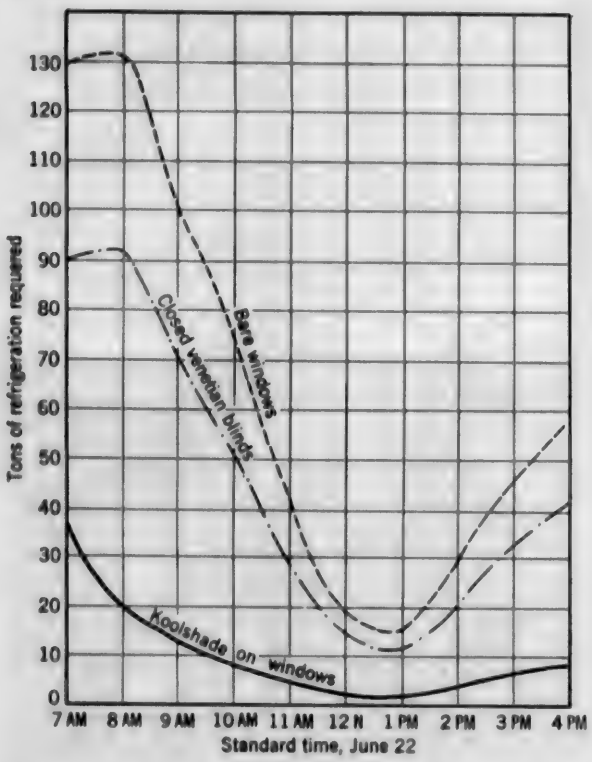
## New, Unusual, or Ingenious Uses of Equipment and Materials

**Conducted by WM. B. FOXHALL, Associate Editor**

### Shading Screen Cuts Cooling Load

**RESULTS:** There was a reduction of 870,000 Btu in cool- County Engineers Building resulted in calculation showing that peak solar load through glass windows could be handled by about 112 tons of refrigeration. The 9-story building faces northeast so that all four outer walls are exposed to the sun at sometime during a working day. Each wall has about 5000 sq ft of glass.

**SOLUTION:** A chart was drawn up showing the heat bulbs imposed through bare windows, through closed venetian blinds, and through KoolShade, a shading screen produced by Reflectal Corp., a subsidiary of Borg-Warner. Calculations were based on figures shown on Table 1 from HEATING AND VENTILATING, April, 1941. These figures show solar heat gains in excess of air-to-air conduction as a percent of the gain through bare, unshaded single windows.




The screen is an arrangement of thin horizontal strips set at an agle of 17 deg to exclude the maximum amount of summer sun while permitting visibility from inside. The strips form miniature louvers .058 inch wide and .0045 inch thick and are secured in place by twisted wires at half inch intervals. The horizontal strips, made of pre-oxydized bronze, are set 17.4 horizontal louvers to the inch, and act as an insect screen as well. The shade screen installed on all nine floors facing southeast and northeast and on six floors facing southwest and northwest. Cost of the screen installation totaling 19,800 sq ft of screen was $44,300.

**TABLE 1—SOLAR HEAT GAINS THROUGH WINDOWS**
(In per cent of that through bare unshaded single windows. Figures are in excess of air-to-air conduction)

| | |
|---|---|
| Bare Window | 100% |
| Inside Green Roller Shade* | 94 |
| Double Glazed Window, plain glass | 92 |
| Inside Aluminum Venetian Blinds | 74 |
| Heat Absorbing Glass, single | 68 |
| Inside Buff Roller Shade, half-drawn | 68 |
| Double glazed window, one plain glass and one heat absorbing glass | 62 |
| Inside Venetian Blinds, 45° drawn* | 58 |
| Inside Aluminum and Buff Roller Shade | 45 |
| Outside Venetian Blind* | 39 |
| Outside Shading Screen (Koolshade)* | 30 |
| Canvas Awning* | 29 |

*Figures given based on tests covering the period from 1 to 6 p.m., west wall. For the complete period tested (1 to 7 p.m.) the averages are as follows: green roller shade, 95.1%; inside venetian blinds, 60.6%; outside venetian blinds, 35.3%; shading screen, 30.6%; canvas awning, 33.8%.

Before

After

**RESULTS:** There was a reduction of 870,000 Btu in cooling load, enough to reduce the refrigeration equipment requirements by 72 tons at a saving, over and above the cost of KoolShade, of $13,300. There is an additional saving in operating and maintenance cost on 72 tons of refrigeration equipment. Screens make it possible to leave venetian blinds open during the peak solar heat gain periods, allowing personnel to work under natural light.

### Burner Timer Saves Fuel

**PROBLEM:** The Rhodes Oil and Burner Corp. of New York offers a seven-year package including a No. 6 oil burner, all required fuel regardless of weather conditions, and complete maintenance for parts and labor under a single contract. In one of the buildings that they service, an extensive amount of fuel was being burned.

**SOLUTION:** A Heat Recorder-Totalizer product of Heat-Timer Corp. of New York, was installed to record the

(*Continued on page* 138)

# *Sure* . . . you can cut firing costs by burning heavy fuel oil . . .

## but you've got to control the oil feed

## and Petro does this superlatively well without complicated gadgets

The so-called viscosity problem with heavy oils is overrated. This is so because the viscosity of *all* fuel oils approaches a common point as the temperature is raised, and the temperature at which viscosity becomes a negligible factor is well within a practical operating range.

The Petro thermal viscosity control system is simply this: an electric valve controlled by the oil temperature refuses to admit oil to the atomizing cup until the oil has reached a desirable burning temperature. This temperature is arrived at by circulating the oil through heaters when necessary. This accomplishes four important results:

1. Viscosity control permits accurate metering of oil.
2. Oil is thin enough for extremely fine atomization.
3. Hot oil ignites easily.
4. Petro *never* has a slug of cold oil in the feed line to foul up a cold start.

That is why the Petro burner can fire the economical heavy oils without a fearsome array of fancy trimmings. It is fool proof, gadget free, and completely dependable—all good reasons why Petro is the largest selling industrial oil burner in America.

**A reservoir of warm oil is maintained.** In the use of this thermal viscosity system, all of the heated oil which is not required for immediate firing is returned to the storage tank. Thus a constant pool of warm oil is ready for any changes in firing needs. The amount of oil being returned is easily regulated by the owner of the burner, to suit his individual needs.

**No manual attention is required**

The entire operation is automatic. There are no involved mechanical controls requiring adjustment or maintenance.

**Saves labor costs—saves fuel costs**

Why don't you find out how much Petro industrial oil burners can save for you? They are quickly adaptable to nearly every existing boiler. Send in the coupon below for full information.

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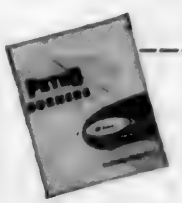
*OVER 50 YEARS OF LEADERSHIP IN AUTOMATIC HEATING AND POWER EQUIPMENT*



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Please send me literature and specification sheets on money-saving Petro commercial and industrial burners.

Name _____

Company _____

Address _____

City _____ State _____

(*Continued from page* 136)

operation cycles of the burner. Although the boiler was set to provide hot water, it was found that the burner operated frequently at night in spite of the fact that there was no hot water demand during that period. In the daytime the burner operated an excessive amount of time in order to provide hot water demand.

**RESULTS:** By studying the pattern of operation of the burner as reported by the recording device, engineers were able to locate the trouble, an undersize coil, and by relocating the aquastat, demonstrate that the hot water coil was installed on the wrong side of the boiler. When the coil was reset, a second series of recordings showed that the burner operated at more economic frequency.

## Humidity Control Aids Wrapper Printing

**PROBLEM:** Higher packaging line speeds and the increased use of temperature and moisture-sensitive films as packaging materials require accurately controlled air conditions during storage, manufacturing and processing. Shellmar Products Corp. of Mt. Vernon, Ohio, a supplier of protective packages and wrappers, discovered that it was difficult to get top quality printing on materials which had been exposed to excessive temperature or humidity. The printing process itself was affected by atmospheric conditions. Packaging materials would swell or contract, edges would tear, chemical solutions would lose their concentrations and gelatin coatings would not dry properly under adverse conditions.

**SOLUTION:** To eliminate those problems, Shellmar installed a Kathabar dehumidification system. The system is designed to maintain optimum operating conditions of 78 deg F and 45% R. H. in manufacturing rooms as well as to provide comfort air conditioning in the general offices.

**RESULTS:** Success of in the installation led Shellmar to install additional Kathabar units in the testing laboratory. Cellophane, films, glassine, and special papers used as packaging material now can be handled with a minimum of spoilage.

## Ventilation Stars at Summer Theatre

**PROBLEM:** At the Gateway Musical Playhouse, Somers Point, New Jersey, said to be the largest summer theatre in the country, management was faced with the problem of maintaining comfort and adequate air movement in an enclosed volume of 375,000 cubic feet.

**SOLUTION:** Eleven power roof ventilators were installed with a combined air moving capacity of 200,500 cfm, providing a complete air change every 1.8 minutes. Ventilators are a product of ILG Electric Ventilating Company of Chicago. Air replacement is accomplished through 30,000 holes, ¾ inch in diameter, drilled in the floor. Cool air from the basement rises through these holes (20 under each seat) as warm, stale air is exhausted by the roof ventilators. A large plenum separates the ceiling from the roof, and there are eight openings from the auditorium and stage to the plenum. Side openings and floor grills provide some additional outside air access.

**RESULTS:** This system, which was designed by engineers of the company supplying the equipment, provides an equally comfortable and pleasant atmosphere in all sections of the theater—even in corners which might normally be expected to trap pockets of still air. Virtually silent operation is assured by fans which are directly connected to roof ventilator motors. Ventilators are installed in pent houses on the roof of the theater.

## Infrared Heaters Warm Loading Platform

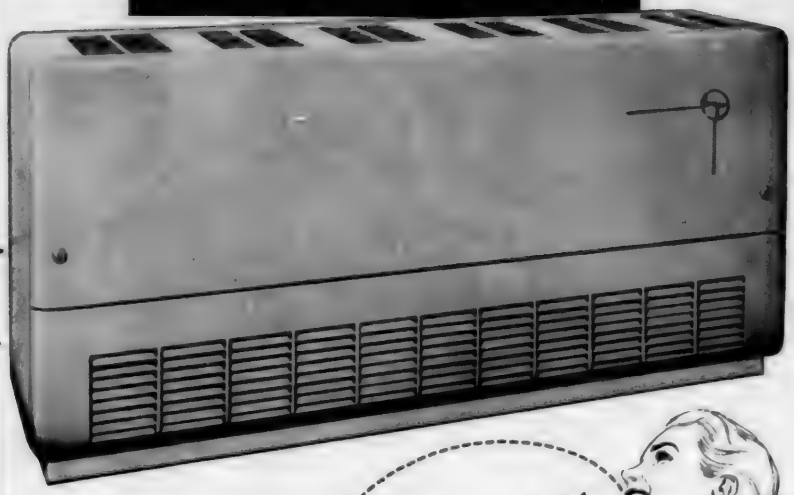
**PROBLEM:** When buildings adjacent to the loading platform of Pittsburgh's morning newspaper, the Post-Gazette, were razed to make way for a new highway, the platform became directly exposed to cold blasts of air sweeping in from the nearby Monongahela River. Overhead steam radiators, previously adequate to offset penetrating cold, proved incapable of neutralizing the icy drafts. A heating source was needed that could be installed easily and which could cut into the drafts as they reached the platform.

**SOLUTION:** Ten Chromalox electric radiant heaters, product of Edwin L. Wiegand Company, proved adaptable to the newspaper plant's 208 volt system and were placed along the whole length of the platform. Some were installed overhead and others were placed horizontally along the lower portion of the platform for leg and foot comfort. All units are individually operated from a control panel at one end of the platform. A safety switch in the basement provides simultaneous shut-off of all heaters.

**RESULTS:** In zero and sub-zero weather of January, the heaters functioned well, and provided comfort to loading personnel. Company electricians believe that when the last remaining building which provides a barrier against river winds is demolished, the new heaters will provide adequate protection from the resulting complete exposure.

# Better Air is Our Business!

## HERMAN NELSON
console heater



# Now choose from 16 models... 64 air inlet-outlet arrangements!

When you apply the Herman Nelson Console Heater to your heating jobs, you apply not one or two choices but *16 different models*—giving you a total of *64 inlet-outlet combinations!* Mount these Herman Nelson units on floor, wall, ceiling or inverted . . . order them for fully recessed, semi-recessed or free-standing applications—and get the unit that *fits your requirements exactly*. Styled with outstanding beauty, Herman Nelson Console Heaters operate quietly, give positive heat distribution, and utilize either steam or hot water. Get complete information now . . . use coupon below.

| FLOOR INSTALLATION | WALL INSTALLATION | INVERTED INSTALLATION | CEILING INSTALLATION |
|---|---|---|---|
| Top Discharge | Top Discharge | Top Discharge | Top Discharge |
| Front Discharge | Front Discharge | Front Discharge | Front Discharge |
| Fully Recessed | Fully Recessed | Fully Recessed | Fully Recessed |
| Semi-Recessed | Semi-Recessed | Semi-Recessed | Semi-Recessed |

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**UNIT BLOWERS, in both forward curve and backward curve wheel types, efficiently solve all ventilating and exhaust problems.**

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**American Air Filter**
COMPANY, INC.
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# DEGREE-DAYS FOR JUNE, 1955

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

AIR CONDITIONING, HEATING AND VENTILATING's 27th Year of Publication of Monthly Degree-Day Data

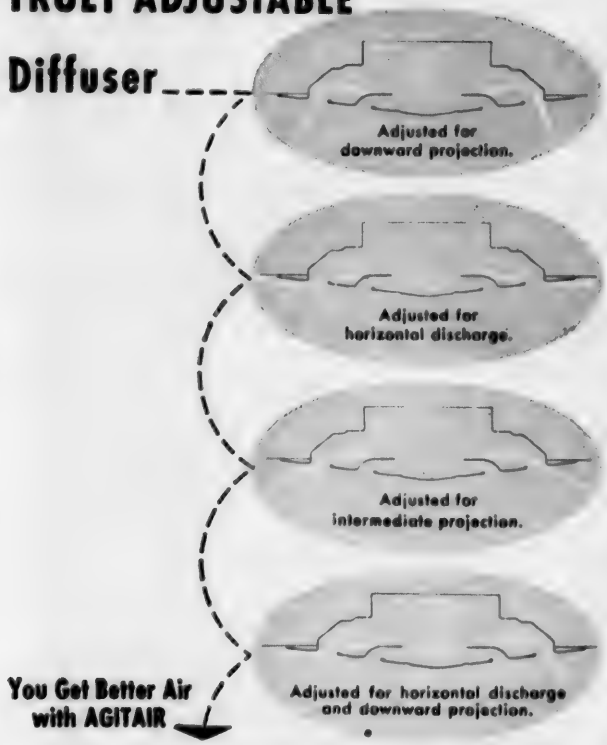
| City | June | | | Season to June 30, incl.* | | |
|---|---|---|---|---|---|---|
| | 1955 | 1954 | Normal | 1954-55 | 1953-54 | Normal |
| Abilene, Texas (A) | 4 | 0 | 0 | 2269 | 2344 | 2707 |
| Albany, New York (A) | 41 | 35 | 50 | 6518 | 6348 | 6938 |
| Albuquerque, New Mexico (A) | 2 | 2 | 0 | 4249 | 3787 | 4389 |
| Alpena, Michigan (C) | 93 | 109 | 135 | 7383 | 8277 | 7938 |
| Anaconda, Montana (C) | 245 | 377 | 251** | 8427 | 7400 | 8261** |
| Asheville, North Carolina (C) | 46 | 19 | 5 | 4109 | 3929 | 4072 |
| Atlanta, Georgia (A) | 0 | 7 | 0 | 2751 | 3595 | 2826 |
| Atlantic City, New Jersey (C) | 40 | 12 | 24 | 4674 | 4251 | 4741 |
| Augusta, Georgia (A) | 0 | 0 | 0 | 2537 | 2357 | 2138 |
| Baltimore, Maryland (C) | 14 | 0 | 0 | 4046 | 3636 | 4203 |
| Billings, Montana (A) | 115 | 168 | 119 | 6905 | 6561 | 7078 |
| Binghamton, New York (C) | 49 | 26 | 48 | 6193 | 6025 | 6520 |
| Birmingham, Alabama (A) | 0 | 3 | 0 | 2686 | 2641 | 2788 |
| Bismarck, North Dakota (A) | 119 | 131 | 116 | 8184 | 8153 | 8967 |
| Block Island, Rhode Island (A) | 111 | 67 | 96 | 5553 | 5157 | 5816 |
| Boise, Idaho (A) | 69 | 172 | 42 | 6535 | 5287 | 5784 |
| Boston, Massachusetts (A) | 73 | 61 | 42 | 5468 | 5185 | 5784 |
| Bozeman, Montana (C) | 256 | 306 | 230** | 8427 | 7345 | 8425** |
| Buffalo, New York (A) | 37 | 56 | 72 | 6187 | 6099 | 6792 |
| Burlington, Iowa (A) | (a) | 35 | 34 | (a) | 5525 | 6101 |
| Burlington, Vermont (A) | 44 | 63 | 72 | 7416 | 7172 | 7799 |
| Butte, Montana (C) | 239 | 343 | 236** | 8821 | 7600 | 8162** |
| Cairo, Illinois (C) | 9 | 2 | 0 | 3542 | 3496 | 3756 |
| Charleston, South Carolina (C) | 0 | 0 | 0 | 1822 | 1591 | 1769 |
| Charlotte, North Carolina (A) | 1 | 1 | 0 | 3082 | 3016 | 3205 |
| Chattanooga, Tennessee (A) | 1 | 5 | 0 | 3277 | 3200 | 3384 |
| Cheyenne, Wyoming (A) | 224 | 143 | 173 | 7163 | 6553 | 7490 |
| Chicago, Illinois (C) | 58 | 44 | 59** | 5454 | 5315 | 6077** |
| Cincinnati, Ohio (C) | 14 | 14 | 0 | 4199 | 4044 | 4532 |
| Cleveland, Ohio (A) | 35 | 36 | 46 | 5414 | 5349 | 5996 |
| Columbia, Missouri (A) | 29 | 22 | 14 | 4550 | 4458 | 5107 |
| Columbia, South Carolina (A) | 0 | 0 | 0 | 2605 | 2119 | 2284 |
| Columbus, Ohio (C) | 21 | 23 | 22 | 4886 | 4523 | 5255 |
| Concord, New Hampshire (A) | 89 | 85 | 82 | 7000 | 6763 | 7544 |
| Concordia, Kansas (C) | 36 | 26 | 20 | 4931 | 4770 | 5323 |
| Dallas, Texas (A) | 0 | 0 | 0 | 2146 | 2166 | 2272 |
| Dayton, Ohio (A) | 37 | 32 | 39 | 5248 | 4854 | 5591 |
| Deer Lodge, Montana (C) | 263 | 337 | 235** | 8715 | 7454 | 8582** |
| Denver, Colorado (A) | 105 | 42 | 65 | 5863 | 5074 | 6116 |
| Des Moines, Iowa (A) | 44 | 39 | 45 | 6006 | 5881 | 6429 |
| Detroit, Michigan (A) | 27 | 46 | 60 | 5820 | 5807 | 6396 |
| Devils Lake, North Dakota (C) | 119 | 144 | 137 | 9225 | 9156 | 9832 |
| Dodge City, Kansas (A) | 29 | 16 | 15 | 4615 | 4565 | 5058 |
| Dubuque, Iowa (A) | 67 | 51 | 76 | 6827 | 6607 | 7235 |
| Duluth, Minnesota (C) | 151 | 180 | 200 | 9158 | 9116 | 9417 |
| Elkins, West Virginia (A) | 130 | 53 | 53 | 5805 | 5653 | 5733 |
| El Paso, Texas (A) | 0 | 0 | 0 | 2523 | 2434 | 2641 |
| Ely, Nevada (A) | 219 | 248 | 200 | 8235 | 6999 | 7377 |
| Escanaba, Michigan (C) | 100 | 123 | 166 | 7750 | 7776 | 8500 |
| Evansville, Indiana (A) | 29 | 15 | 6 | 4293 | 4240 | 4360 |
| Fargo, North Dakota (A) | 75 | 75 | 101 | 8713 | 8639 | 9208 |
| Fort Smith, Arkansas (A) | 6 | 2 | 0 | 3102 | 3183 | 3188 |
| Fort Wayne, Indiana (A) | 42 | 43 | 53 | 5694 | 5586 | 6270 |
| Fort Worth, Texas (A) | 0 | 0 | 0 | 2193 | 2252 | 2361 |
| Fresno, California (A) | 5 | 21 | 0 | 3044 | 2523 | 2532 |
| Galveston, Texas (C) | 0 | 0 | 0 | 990 | 1024 | 1211 |
| Grand Junction, Colorado (A) | 42 | 40 | 23 | 6187 | 4970 | 5796 |
| Grand Rapids, Michigan (A) | 44 | 62 | 79 | 6353 | 6291 | 7027 |
| Green Bay, Wisconsin (A) | 64 | 78 | 107 | 7722 | 7382 | 8169 |
| Greensboro, North Carolina (A) | 10 | 6 | 0 | 3795 | 3634 | 3810 |
| Greenville, South Carolina (A) | 6 | 1 | 0 | 3107 | 2855 | 3060 |
| Harrisburg, Pennsylvania (A) | 29 | 10 | 14 | 5048 | 4820 | 5258 |
| Hartford, Connecticut (A) | 70 | 21 | 31 | 5853 | 5460 | 6125 |
| Hatteras, North Carolina (C) | 0 | 0 | 0 | 2523 | 1958 | 2392 |
| Havre, Montana (C) | 120 | 190 | 125 | 7763 | 7729 | 8155 |
| Helena, Montana (A) | 197 | 287 | 197 | 8452 | 7358 | 8202 |
| Houston, Texas (C) | 0 | 0 | 0 | 1134 | 1121 | 1276 |
| Huron, South Dakota (A) | 71 | 58 | 60 | 7319 | 7413 | 7876 |
| Indianapolis, Indiana (A) | 51 | 24 | 30 | 5270 | 5036 | 5581 |
| Jackson, Mississippi (A) | 0 | 0 | 0 | 2233 | 2151 | 2202 |
| Kansas City, Missouri (A) | 17 | 10 | 8 | 4347 | 4270 | 4888 |
| Knoxville, Tennessee (A) | 9 | 7 | 0 | 3530 | 3446 | 3590 |
| La Crosse, Wisconsin (A) | 47 | 53 | 74 | 7086 | 6718 | 7619 |

(a) Data not available.
*Heating season, cumulative, from Sept. 1.
**Same normal figures as previously listed by HEATING AND VENTILATING since new figures are not available. All other normal figures in this table are based on a 30-year period covering 1921 to 1950, inclusive, recently compiled and published by the U. S. Weather Bureau.

Figures in this table, with eight exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company. Tacoma figures through the courtesy of the Tacoma News Tribune.

[Table concluded on page 142]

## Take a look at a TRULY ADJUSTABLE Diffuser


Adjusted for downward projection.
Adjusted for horizontal discharge.
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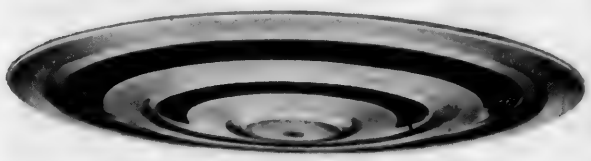
You Get Better Air with AGITAIR



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# Degree-Days for June, 1955 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

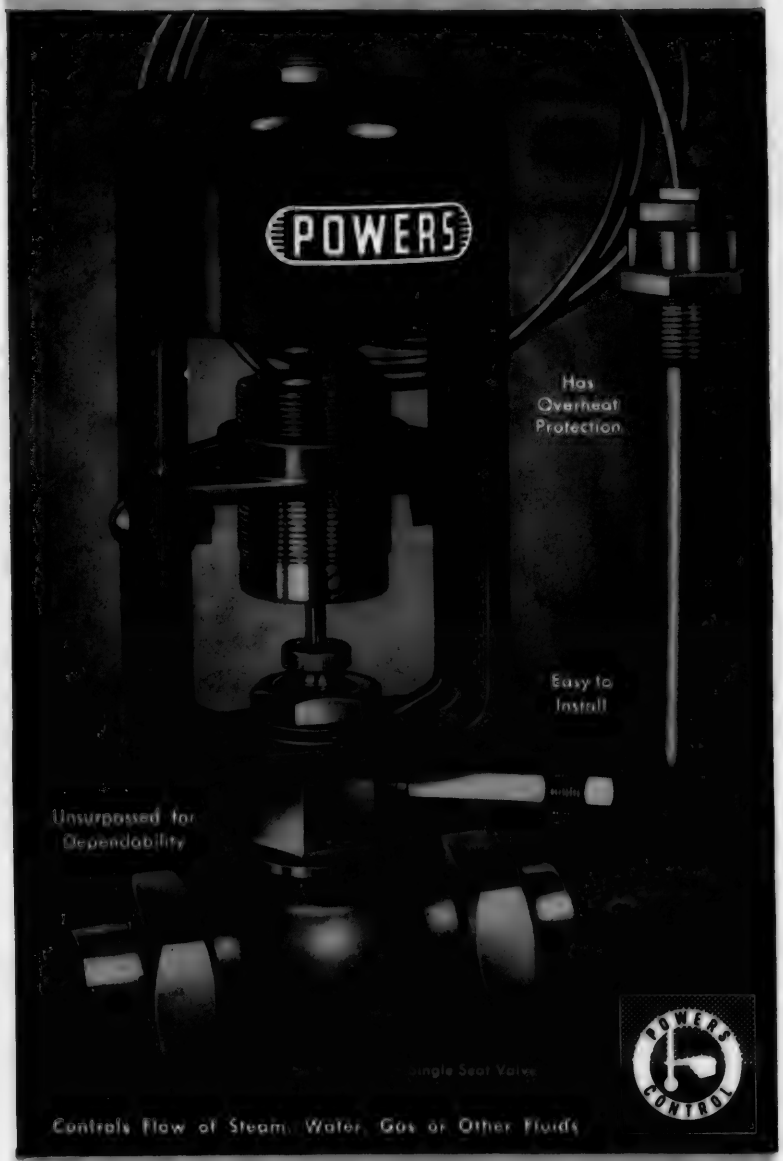
AIR CONDITIONING, HEATING AND VENTILATING's 27th Year of Publication of Monthly Degree-Day Data

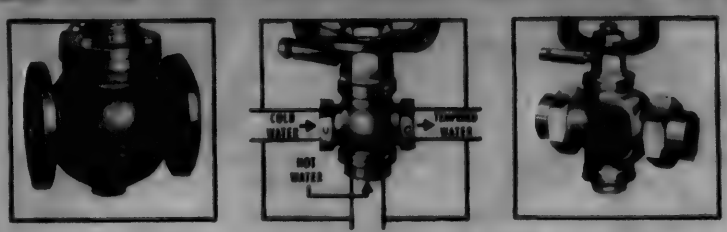
| City | June | | | Season to June 30, incl.* | | |
|---|---|---|---|---|---|---|
| | 1955 | 1954 | Normal | 1954-55 | 1953-54 | Normal |
| Lander, Wyoming (A) | 174 | 166 | 163 | 7720 | 6870 | 8273 |
| Lewiston, Maine (O) | 87 | 126 | 45** | 7060 | 7191 | 7707** |
| Lincoln, Nebraska (C) | 42 | 26 | 32 | 5471 | 5360 | 5858 |
| Little Rock, Arkansas (A) | 0 | 0 | 0 | 2846 | 2800 | 2982 |
| Livingston, Montana (C) | 185 | 284 | 142** | 7448 | 7018 | 7185** |
| Los Angeles, California (C) | 14 | 9 | 19 | 1264 | 1111 | 1451 |
| Louisville, Kentucky (A) | 20 | 12 | 5 | 4168 | 4106 | 4439 |
| Lynchburg, Virginia (A) | 25 | 10 | 5 | 4131 | 3926 | 4153 |
| Macon, Georgia (A) | 0 | 0 | 0 | 2158 | 2032 | 2049 |
| Madison, Wisconsin (C) | 66 | 55 | 79 | 6796 | 6509 | 7260 |
| Marquette, Michigan (C) | 125 | 157 | 189 | 7770 | 7798 | 8373 |
| Memphis, Tennessee (A) | 0 | 0 | 0 | 3028 | 2915 | 3137 |
| Meridian, Mississippi (A) | 0 | 0 | 0 | 2371 | 2303 | 2333 |
| Milwaukee, Wisconsin (A) | 82 | 69 | 109 | 6572 | 6431 | 7153 |
| Minneapolis, Minnesota (A) | 41 | 39 | 80 | 7450 | 7232 | 7828 |
| Moline, Illinois (A) | 44 | 39 | 45 | 5990 | 5817 | 6356 |
| Montgomery, Alabama (A) | 0 | 0 | 0 | 2218 | 2061 | 2137 |
| Nantucket, Massachusetts (A) | (a) | 129 | 139 | (a) | 4650 | 6046 |
| Nashville, Tennessee (A) | 6 | 10 | 0 | 3525 | 3446 | 3513 |
| New Haven, Connecticut (A) | 53 | 31 | 52 | 5631 | 5444 | 6008 |
| New Orleans, Louisiana (C) | 0 | 0 | 0 | 1116 | 1087 | 1175 |
| New York, New York (C) | 41 | 9 | 18 | 4865 | 4431 | 5050 |
| Newark, New Jersey (A) | 34 | 7 | 11 | 4898 | 4740 | 5252 |
| Norfolk, Virginia (A) | 7 | 0 | 0 | 3424 | 3108 | 3454 |
| North Platte, Nebraska (A) | 108 | 45 | 59 | 6578 | 6152 | 6529 |
| Oak Ridge, Tennessee (C) | 22 | 11 | (a) | 3828 | 3707 | (a) |
| Oakland, California (A) | 183 | 124 | 119 | 3300 | 2702 | 3002 |
| Oklahoma City, Oklahoma (A) | 15 | 4 | 0 | 3402 | 3285 | 3519 |
| Omaha, Nebraska (A) | 40 | 24 | 32 | 5602 | 5436 | 6155 |
| Parkersburg, West Virginia (C) | 34 | 14 | 13 | 4645 | 4399 | 4750 |
| Peoria, Illinois (A) | 42 | 31 | 41 | 5551 | 5409 | 6076 |
| Philadelphia, Pennsylvania (C) | 25 | 4 | 0 | 4379 | 4045 | 4523 |
| Phoenix, Arizona (A) | 0 | 0 | 0 | 1436 | 1357 | 1492 |
| Pittsburgh, Pennsylvania (C) | 37 | 16 | 13 | 4754 | 4568 | 5048 |
| Pittsfield, Mass. (A) | 115 | 97 | 105 | 7209 | 6979 | 7606 |
| Pocatello, Idaho (A) | 157 | 205 | 136 | 7902 | 6178 | 6976 |
| Portland, Maine (A) | 124 | 146 | 117 | 7111 | 7074 | 7610 |
| Portland, Oregon (C) | 127 | 176 | 70 | 4488 | 4020 | 4116 |
| Providence, Rhode Island (A) | 87 | 50 | 58 | 5720 | 5510 | 6099 |
| Pueblo, Colorado (A) | 40 | 9 | 27 | 5336 | 4698 | 5709 |
| Raleigh, North Carolina (A) | 3 | 2 | 0 | 3392 | 3004 | 3075 |
| Rapid City, South Dakota (A) | 140 | 108 | 148 | 6795 | 6379 | 7479 |
| Reading, Pennsylvania (C) | 24 | 6 | 11 | 4797 | 4524 | 5055 |
| Red Bluff, California (A) | 4 | 21 | 0 | 3027 | 2436 | 2546 |
| Reno, Nevada (A) | 124 | 193 | 165 | 6537 | 5486 | 5948 |
| Richmond, Virginia (A) | 12 | 1 | 0 | 3884 | 3630 | 3955 |
| Rochester, New York (A) | 35 | 48 | 54 | 6387 | 6245 | 6820 |
| Roswell, New Mexico (A) | 2 | 0 | 0 | 3399 | 3176 | 3424 |
| Sacramento, California (C) | 19 | 22 | 5 | 2961 | 2404 | 2600 |
| St. Joseph, Missouri (A) | 26 | 12 | 11 | 5077 | 4881 | 4703 |
| St. Louis, Missouri (C) | 22 | 9 | 7 | 4129 | 3929 | 4469 |
| Salt Lake City, Utah (A) | 85 | 100 | 81 | 6474 | 5140 | 5866 |
| San Antonio, Texas (A) | 0 | 0 | 0 | 1227 | 1380 | 1579 |
| San Diego, California (A) | 15 | 20 | 43 | 1341 | 1180 | 1556 |
| Sandusky, Ohio (C) | 21 | 28 | 41 | 5323 | 5159 | 5859 |
| San Francisco, California (C) | 239 | 200 | 180 | 2988 | 2560 | 2703 |
| Sault Ste. Marie, Michigan (A) | 108 | 169 | 224 | 8473 | 8616 | 9240 |
| Savannah, Georgia (A) | 0 | 0 | 0 | 2020 | 1716 | 1710 |
| Scranton, Pennsylvania (A) | (a) | 17 | 35 | (a) | 5490 | 6029 |
| Seattle, Washington (C) | 180 | 200 | 107 | 4666 | 4352 | 4344 |
| Sheridan, Wyoming (A) | 144 | 190 | 161 | 7490 | 6954 | 7835 |
| Shreveport, Louisiana (A) | 0 | 0 | 0 | 2042 | 2056 | 2117 |
| Sioux City, Iowa (A) | 46 | 39 | 54 | 6283 | 6312 | 6987 |
| Spokane, Washington (A) | 129 | 237 | 146 | 7146 | 6388 | 6807 |
| Springfield, Illinois (A) | 35 | 26 | 14 | 5105 | 4686 | 5225 |
| Springfield, Missouri (A) | 38 | 14 | 16 | 4283 | 4145 | 4685 |
| Syracuse, New York (A) | 22 | 33 | 37 | 6376 | 6123 | 6491 |
| Tacoma, Washington (C) | 162 | 179 | 143 | 4771 | 4370 | 4738 |
| Toledo, Ohio (A) | 34 | 39 | 60 | 5774 | 5716 | 6382 |
| Topeka, Kansas (C) | 21 | 11 | 13 | 4587 | 4376 | 4919 |
| Trenton, New Jersey (C) | 36 | 14 | 11 | 4855 | 4538 | 5068 |
| Utica, New York (O) | 31 | 57 | 0** | 6839 | 6586 | 6796** |
| Valentine, Nebraska (C) | 119 | 67 | 83 | 6668 | 6262 | 7054 |
| Walla Walla, Washington (C) | 36 | 114 | 38 | 5089 | 4458 | 4848 |
| Washington, D. C. (C) | 15 | 1 | 0 | 4062 | 3778 | 4258 |
| Wichita, Kansas (A) | 20 | 13 | 7 | 2223 | 4158 | 4571 |
| Williston, North Dakota (C) | 129 | 173 | 138 | 8302 | 8353 | 8997 |
| Winnemucca, Nevada (A) | 126 | 207 | 111 | 7314 | 5918 | 6352 |
| Yakima, Washington (A) | 69 | 171 | 53 | 6198 | 5725 | 5838 |

For footnotes, see page 140.

# POWERS No. 11 Self-Operating TEMPERATURE REGULATOR

**Automatically holds temperature constant at the right point. Prevents losses caused by wasteful OVER-heating.**



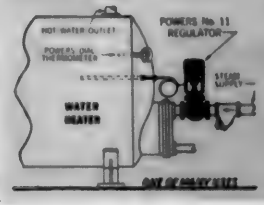




**Various Valve Bodies and Inner Valves are available.** Single and Double Seat Valves thru 2" have rugged bronze bodies with bronze union connections for quick, easy installation. Bulletin 329 gives information about all types.

(488)

## Why It Gives BETTER CONTROL and Saves More Money

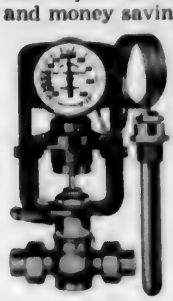
**Often repays its cost 3 to 6 times a year when used on:**




- Water Heaters
- Industrial Processes
- Heat Exchangers
- Fuel and Crude Oil Heaters
- Air Compressors Diesel Engines

## ONLY POWERS No. 11 REGULATOR Offers ALL These Advantages

- **Simple, sturdy construction.** Materials used are corrosion resistant.
- **Powers bellows has 50% more power** than used in the majority of regulators. The heart of a self operating regulator is its bellows. Powers with its 50% greater effective area gives better control and its durable 2 ply bellows outlasts ordinary single ply bellows.
- **Valve stem lubricator** with silicone grease aids easy movement of highly polished stainless steel valve stem and reduces drying out of packing.
- **BETTER CONTROL** results from Powers powerful bellows and minimum of valve stem friction.
- **60°F. temperature ranges** available with accuracy of ±1°F. on some processes and 2 to 3°F. on others.
- **Rugged bronze valve bodies with bronze union connections,** for single and double seat valves thru 2", reduce installation time and labor. Larger sizes have flanged iron body valves.
- **Powers Nationwide Service and 24 Hour Delivery** in the U.S.A. are important time and money saving advantages.



- **Indicating Regulator** with easy to read 4" dial thermometer helps adjust the regulator and check temperature at the bulb. Various dials and ranges are available.

**Right type and size of valve is important for good control.** May we help you make the right selection? Benefit from POWERS more than 60 years experience with self-operating regulators.

*Call our nearest office or write us direct for Bulletin 329.*

**THE POWERS REGULATOR CO.**

Skokie, Ill. | Offices in Chief Cities in U.S.A. Canada and Mexico | See your phone book

**Automatic Temperature and Humidity Control**

Established 1891

# BOOK REVIEWS

*Publications abstracted in this department should be ordered direct from publisher.*

## APPLIED THERMODYNAMICS

Since the publication of the second edition of Heat Power of 15 years ago, there have been many advances in thermodynamics. Therefore, there has been a thorough revision of the 1939 edition before publication of the third edition. This work was done by Clarence E. Trent, professor of mechanical engineering, Virginia Polytechnic Institute, under the supervision of Earle B. Norris, Dean Emeritus, School of Engineering, Virginia Polytechnic Institute. Professor Eric Therkelsen, Montana State College, one of the authors of the previous edition, died before preparation was started on the new edition.

The original title of the book has been changed to Applied Thermodynamics. Many of the problems have been revised and others added. To facilitate problem work, the scope of the appendixes was enlarged.

The text of the book has been divided into 22 chapters plus the appendixes. Some of the chapters are the internal combustion engine, fuels for internal combustion engine, principle of combustion, work and power, heat and work, performance of internal combustion engine, the steam power plant, steam, steam engine performance, steam engine mechanisms, the steam turbine, condensing equipment, steam boilers, boiler fuels and furnaces, boiler accessories and auxiliaries, boiler performance, compressors and refrigeration.

*Applied Thermodynamics by E. B. Norris, E. Therkelsen and C. E. Trent. Cloth bound, 6 x 9 inches, 490 pages. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Price, $7.50.*

## SOLAR ENERGY RESEARCH

A symposium on all phases of the utilization of solar energy, supported in a large part by the U. S. National Science Foundation, was held at Madison, Wis., September 12-14, 1953. At this symposium there were about 30 scientists interested in the field, several of whom had experience in foreign countries. Participants to this symposium reviewed past accomplishments and present progress, and gave glimpses of future possibilities.

Solar Energy Research is edited by Farrington Daniels, Department of Chemistry, University of Wisconsin, and John A. Duffie, Engineering Experiment Station, University of Wisconsin. This book is based rather loosely on the Wisconsin symposium. It is not a detailed account of the proceedings. Each of the participants to the symposium was invited to write a brief report of the subject of his particular interest and these have coincided in part, with the material that was presented at Wisconsin. A few additional experts, who had been unable to attend the symposium were invited to contribute. The result of all this is the present book.

*Solar Energy Research, edited by F. Daniels and J. A. Duffie. Cloth bound, 6 x 9 inches, 290 pages. Published by University of Wisconsin Press, 811 State St., Madison, Wis. Price, $4.*

## THERMODYNAMICS

Written primarily for a one-year undergraduate course, Thermodynamics, by John Francis Lee, professor of mechanical engineering, North Carolina State College, and Francis Weston Sears, professor of physics, Massachusetts Institute of Technology, leans heavily toward basic principles. The authors believe that the interests of the students are better served in this manner than through emphasis on detailed engineering applications.

The first seven chapters are devoted to a thorough treatment of the First and Second Laws and their consequences. Five chapters include the thermodynamic approach to various processes, cycles, and reactive and nonreactive systems.

The authors state that the subject matter has been selected with a view to meeting the needs and interests of undergraduate students in all branches of engineering and dynamics for all students. Problems are an integral part of the text and are designed to aid in the understanding of principles.

*Thermodynamics, by J. F. Lee and F. W. Sears. Cloth bound, 6 x 9 inches, 543 pages. Published by Addison-Wesley Publishing Company, Inc., Cambridge 42, Mass. Price, $7.50.*

• • •

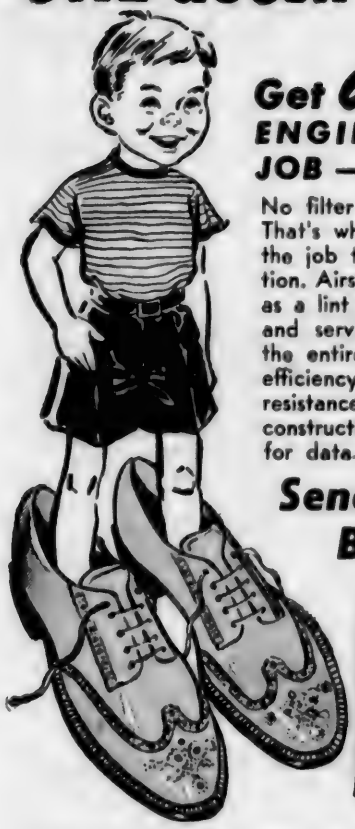
REVISED ACCESSORY STANDARDS—The American Gas Association Approval Requirements Committee has adopted revisions and additions to 14 current American Standards for gas appliances and accessories to become effective January 1, 1956. They apply to domestic gas ranges, incinerators, water heaters, room heaters, boilers, furnaces, floor furnaces, vented recessed heaters, unit heaters, duct furnaces, deep fat fryers, gas conversion burners for domestic gas ranges, domestic appliance pressure regulators and metal connectors for gas appliances. Copies of the revised standards may be obtained by writing to the A. G. A. Laboratories, 1032 East 62nd Street, Cleveland 3, Ohio.

WATER POLLUTION ABATEMENT MANUAL—A 12-page manual, part of a series, has been issued on the subject of water pollution abatement dealing with oils and tars. It discusses permissible concentrations, sources of oils and tars in plants and removal of separable oil from water as well as the disposal of oils. Manufacturing Chemists' Association, Inc., 1625 Eye Street, Northwest, Washington 6, D. C. Price, 25 cents.

GAS APPLIANCE VENTING SYSTEMS—Research Bulletin No. 68 on Literature Review and Design Studies of Gas Appliance Venting Systems has been issued by the American Gas Association Laboratories. It presents information on venting conditions during steady state operation of gas appliances, and the design and operation of venting systems. It has sections devoted to excessve updrafts, downdrafts, draft hoods, methods of system inspection and correction of defects, causes and correction of condensate in chimney and vent pipes. American Gas Association Laboratories, 1032 E. 62nd St., Cleveland 3, Ohio. Price, $2.50.

(*Concluded on page* 163)

# ONE doesn't fit ALL needs!



## Get *Airsan* Filters
### ENGINEERED TO FIT THE JOB — RIGHT EVERY TIME

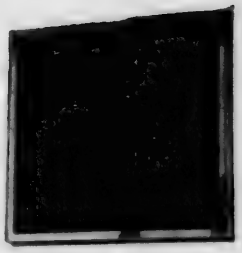
No filter does all jobs, meets every need. That's why Airsan Filters are engineered to the job to offer more effective dust collection. Airsan's expanded metal face plate acts as a lint arrestor to provide easier cleaning and servicing. It distributes air easily over the entire filter area. Provide high filtering efficiency and dust holding capacity with less resistance. Features include all galvanized construction and welded lock corners. Write for data.

**Send for Free Bulletins**

AFI MEMBER AIR FILTER INSTITUTE

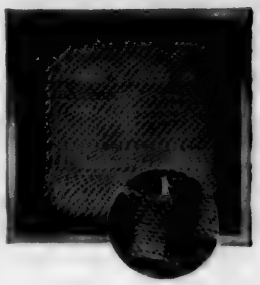
**AIR FILTERS**
*(Low Velocity)*

Viscous type, permanent and cleanable designed for industrial, commercial and domestic use. Available in 1" and 2" thickness.



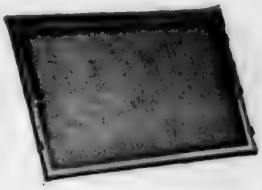
**VIRO-CRIMP**
*(High Velocity)*

Has a specially designed high velocity Viro-Crimp filter core. Hemmed edges provide a safety feature. Operates efficiently at 300 to 500 fpm. Available in 2" and 4" thickness.



**GREASE FILTERS**

Permanent, cleanable type Airsan Grease Filters made especially for range canopies, galleys, kitchens. Available in 2" thickness.



**Air Filter Corporation**

108H NORTH WATER ST. • MILWAUKEE 2, WIS.

Canadian Representative
DOUGLAS ENGINEERING CO., LTD., MONTREAL

**A Few Distributorships Available. Write for Details!**

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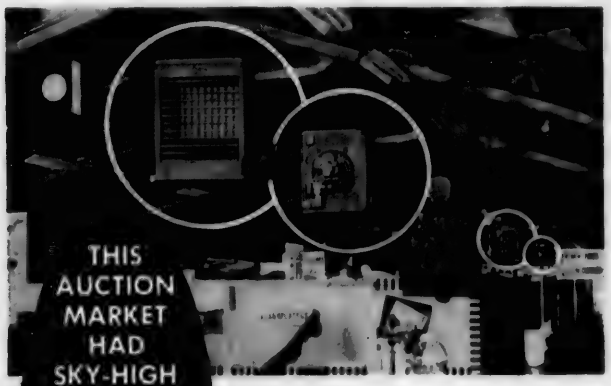

THIS AUCTION MARKET HAD SKY-HIGH FUEL BILLS ... until *Delta* OIL UNIT HEATERS cut them down!

**PROBLEM:** Open only on weekends, this large, drafty farmer's auction market used abnormal quantities of fuel and still never warmed up sufficiently.

**SOLUTION:** 8 Delta oil-fired unit heaters were installed. They run on low cost #2 fuel oil and give immediate warm-up. Adjustable louvres direct heat where needed ... without cold spots, overheating or heat wasted on walls or ceilings.

**RESULTS:** The market now is comfortably heated in an hour. Fuel bills have been cut almost 50%.

*Send for complete new catalog*

This is only one of hundreds of jobs that a Delta Oil Unit Heater can do better and more economically.

**DELTA HEATING CORPORATION**
TRENTON 8, NEW JERSEY

AUTOMATIC HEATING

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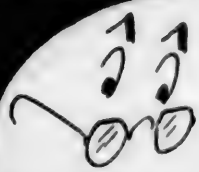

**NO GLASSES NEEDED**

**TO READ OR SET THIS THERMOSTAT!**

*It's Handsome...*
*Easy to read*
*Easy to set*
*..."Thermostyled" to Complement Any Interior!*

Watch for the *Classic* in This Magazine Next Month!

**DETROIT CONTROLS** CORPORATION
5900 TRUMBULL AVE., DETROIT 8, MICHIGAN
Division of AMERICAN RADIATOR & STANDARD SANITARY Corporation

# NEWS OF THE MONTH

## CONSTRUCTION REVIEW

**reveals record levels of contract awards for first half of this year. No sign of downturn.**

During the first half of 1955, the construction industry has operated at high levels which have surprised even some of the more optimistic observers, according to Dr. George C. Smith, economist for F. W. Dodge Corp. Construction contract awards in the 37 eastern states totalled nearly $12 billion in the first six months of 1955. This tremendous total set a new record for any first six months some 30% ahead of the previous record which was established only last year. Five of the six months were at record levels, May being the only exception.

• **TRENDS.**—A closer look at the details, said Dr. Smith, reveals these significant trends:

(1) There has been a very sharp reversal of the downtrend in industrial construction which followed the Korean War, far beyond the expectations of government and private forecasters. The upturn this year has been very broadly based, affecting nearly all major categories of manufacturing.

(2) Contracts for new residential construction have continued to show large increases over the preceding year, with practically all of the emphasis on single-family homes. Apartment construction accounted for a smaller proportion of residential building in the first half of 1955 than in any corresponding period on record.

(3) Every major category of construction showed increases over last year, most of them substantial.

(4) The smallest increase over the first half of last year in any major category, rather surprisingly, was in educational buildings, up only 4%. The educational total was huge, however, amounting to slightly over a billion dollars for a new all-time record.

• **MANUFACTURING.**—Late last year, government surveys indicated that manufacturers' plans for new plant and equipment expenditures called for a continuation in 1955 of the decline which set in after the Korean War. However, early this year contract awards for industrial construction began to increase sharply, prompting the prediction by those who follow these statistics that the plant and equipment forecasts would be revised upward. This prediction has already turned out to be correct.

Awards for manufacturing buildings during the first half of this year totalled $850,085,000, some 46% ahead of the corresponding figure for last year and the highest for any first half since World War II except 1951, when huge atomic energy awards swelled the total.

The manufacturing upturn had an extremely broad base. The manufacturing contract awards are tabulated on the basis of 23 major categories, and no less than 18 of these reported increases over last year, some ranging into magnitudes of several hundred percent.

The largest group, chemicals and allied products, was up 140%. Other large categories showing striking increases were the stone, clay and glass products group, up 341%, and the primary ferrous metal industries, up 331%. (By coincidence, each went from a little more than $14 million last year to more than $63 million this year.) Other sizeable percentage increases were in paper, petroleum refining, printing and publishing, textiles, leather, fabricated metal products, machinery, ordnance and petroleum and coal products.

The five categories which reported decreases below last year were food, primary non-ferrous metals, aircraft, electrical machinery and equipment, and miscellaneous transportation equipment.

• **COMMERCIAL.**—Contract awards for commercial construction continued their spectacular rise. For the first time in history, these awards totalled over a billion dollars in the six month period. The new record of $1,077,957,000 was 21% ahead of last year, the previous record.

Five of the six categories of commercial construction tabulated by Dodge increased over last year, the only exception being office and loft buildings, which were down a little more than 7%.

Biggest category was store buildings, which reached more than half a billion dollars, 42% above last year's record. Largest percentage increase was in restaurant buildings, up 74%. Bank buildings were up more than 52%; garages and service stations rose nearly 18%; and commercial warehouses rose slightly.

• **RESIDENTIAL.**—The emphasis on single-family homes, which was pronounced last year, became even more striking this year. These houses accounted for 88% of the dwelling units for which contracts were awarded in the first half of 1955, the highest proportion ever recorded during the period for which comparable statistics are available.

Contract awards for residential construction totalled $5,456,730,000 in the first half of 1955. This phenomenal total was 37% ahead of last year's all-time record.

The large increase this year was primarily accounted for by single-family homes built for sale or rent, which totalled $3.8 billion and set a new record 46% ahead of last year, which in turn had been 37% ahead of the previous record set in 1953. However, awards for non-speculative building of one-family houses (that is, houses built on order for owner occupancy) also set a new record approximately 25% above last year.

Awards for apartment construction halted the steady decline which had prevailed ever since the 1951 peak in this category, and the total of $370 million was about 7% ahead of last year. However, apartments remained at a relatively low ebb in relation to total residential construction.

Awards for hotels and dormitories increased over last year, up 11% and 17% respectively. Both set new records, with a combined total of $131 million.

• **EDUCATIONAL BUILDINGS.**—Contracts for educational buildings totalled $1,042,787,000, an increase of only 4% over last year, but enough to set a new high mark. Since all other major categories increased faster, this represents a decline in the relative importance of educational build-

(*Continued on page* 152)

# Ad-Digest SERVICE

**Below and on the following pages are given brief digests of the advertisements appearing in this month's issue. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.**

**NOTE: While every attempt is made to list all advertisements, those which are received after the published closing date may not appear. The Index of Advertisers lists all the advertisments in this issue.**

**CONSOLE HEATERS.** Page 139. Console heaters are made in 16 different models that offer a total of 64 inlet-outlet combinations. They can be mounted on the floor, wall, ceiling, or inverted, in fully-recessed, semi-recessed, and free-standing applications. The heaters operate on either steam or hot water. Information is available. ----------Item 201

**ACCESSORY MOTORS.** Page 131. Accessory motors are designed for use on various domestic appliances as well as for air conditioners, marine pumps, and blowers. This motor is wound for both d-c and a-c and is available in sizes from 1/100 hp to ¼ hp. Specifications are available ----------Item 202

**STEAM GENERATORS.** Page 34. Steam boilers, made by a manufacturer with 107 years of experience, incorporate the latest advances in package boiler design. The boilers are made in 20 sizes from 10 to 600 hp, with 15 to 200 psi water pressure, for oil, gas or oil-gas combinations with a quick fuel switch over feature. Boiler details are available. ----------Item 203

**COPPER TUBE DEPOTS.** Page 35. Wherever jobber's warehouse may be located, it is within easy reach of a copper tube depot. This manufacturer makes tubing and only tubing in its modern, integrated mills. ----------Item 204

**CENTRIFUGAL PUMPS.** Page 31. A line of centrifugal pumps for air conditioning is available in a range of sizes from 1/3 to 3 hp, motor-mounted or belt-driven models. The pumps are made in two casing sizes with a bronze impeller, removable bronze wearing rings, a rotary seal, and a corrosion-resistant shaft. Capacities to 90 gpm and heads to 135 ft. Pump bulletin is available. ----------Item 205

**TEMPERATURE REGULATORS.** Page 40. When installing a new or replacing an old temperature regulator, look for packless construction; a guarantee against wire drawing; a broad control range; easy maintenance; double duty; and self-operation. These points are important, and this manufacturers' regulators offer all these features and more. Bulletin on temperature regulators is available. -------Item 206

**RADIANT HEATING SYSTEMS.** Page 44. A radiant heating system was installed in a school for cerebral palsy children. Majority of the pipe used in private rooms was ¾-in. standard and the supply mains through the hallways in sizes up to 2 in. in diameter. Steel pipe meets the requirements of such applications because of its uniform bending and strong welding properties. Bulletin on radiant heating and snow melting applications is available. ----------Item 207

**COOLING TOWERS.** Page 16. These cooling towers have a 20-year guarantee on the wetted deck surface against rotting or fungus attack. Equipped with stainless steel fans, the towers are available in capacities from 3 to 130 tons. Matching condensers for the towers are available in capacities from 1/3 to 25 tons. Write for detailed specifications. ----------Item 208

**AIR EXHAUSTERS.** Page 44. Air exhausters with a low contour meet functional and aesthetic demands by blending with building design concepts. The exhausters are equipped with a motor that is guaranteed for ten years of service. ------Item 209

**TEMPERATURE CONTROL.** Back cover. Turn temperature control problems over to this manufacturer, who has over 70 years of experience in solving temperature, humidity, and air conditioning control problems. The company assumes responsibility for control jobs, and its systems are engineered to fit the needs of individual heating, ventilating, or air conditioning installations. An engineer from the company's nearby branch will make recommendations without obligation. ----------Item 210

**PACKAGED AIR CONDITIONERS.** Page 12. Two 5-ton packaged air conditioning units provide the air conditioning for four operating rooms and one sterilizing room of a hospital. The units save the cost of six tons and require only 34 sq. ft. of space. Made in sizes from 3 to 15 tons, the units can be used singly or multiple to meet air conditioning needs of any building. Air conditioning data is available. ----------Item 211

**SERVICE MANUAL.** Inside back cover. A 72-page service manual containing material adaptable to air handling or conditioning jobs includes a 24-page section covering a new line of sprayed coil equipment designed for cooling and dehumidifying service in central station air conditioning systems. Copies of the catalog are available. ----------Item 212

**COPPER DRAINAGE TUBE.** Page 61. Copper water tube in 20-ft. lengths cuts the installation time of water lines from cellar to attic. Copper tube is lightweight, easy to handle, and can be joined with solder joints. ----------Item 213

**ADJUSTABLE AIR DIFFUSERS.** Page 141. An adjustable air diffuser can control the air direction at four different angles of discharge simultaneously without changing the position of the spinnings. It can be adjusted for downward projection, horizontal discharge, intermediate projection, and horizontal discharge and downward projection. Data, performance charts, and construction details are available. ----------Item 214

**HOTEL AIR CONDITIONING.** Page 12. In 1934, this company installed air conditioning equipment in part of a Southern hotel. Two years later it installed an ice-making system, and in 1941 it installed additional cooling capacity. Seven of the company's heavy-duty compressors carry the load. Literature and estimates are offered to owners and to engineer-contractors. Three bulletins are available. ----------Item 215

**Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.**

**PLEASE SEND US MORE INFORMATION**

**Circle below item numbers on which you wish further information.**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 |
| 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 |
| 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 |
| 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 |
| 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 |
| 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 |

**PLEASE PRINT** Aug. AD-55

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# Ad-Digest SERVICE

**LOW PRESSURE INSULATION.** Page 52. Low pressure pipe insulation stands up under severe conditions of service whether on low pressure steam, hot water, or dual temperature lines. The insulation comes pre-formed in sections to fit standard pipe up to 12 in. in diameter and to fit copper tubing up to 3 in. Its finishes, including a vapor barrier for anti-sweat cold water applications, are factory-applied. Technical bulletin is available. .....Item 214

**CONVECTOR RADIATION.** Page 58. Thirty types of convectors are made in 40 sizes for public, commercial, and institutional buildings. The deluxe, standard, and institutional models include free-standing, fully- and partially-recessed and concealed and wall-hung types with many designs and variations. Catalog of convectors is available. .....Item 217

**STEAM BOILERS.** Page 57. Steam boilers, with the fan mounted inside the front hinged door, are made with four-pass construction and five sq. ft. of heating surface per boiler hp. Eleven sizes from 15 to 150 hp, 70 models, steam or hot water, are made for oil, gas, or combination oil and gas use. Other models are available to 600 hp. Bulletin containing specification data is available. .....Item 218

**CONDENSING UNITS.** Page 9. This manufacturer of refrigeration equipment for commercial and industrial applications makes condensing units which range from ¼ to 75 hp for high, medium, low, and extremely low temperature work. The company's wide range of refrigeration equipment offers types and sizes for specific refrigeration requirements. Item 219

**HOW TO TRAP UNIT HEATERS.** Inside front cover. The way to trap unit heaters is described in the steam trap book published by this manufacturer of steam traps. The 44-page catalog is a guide to good trapping practice. Copies are available. .....Item 220

**AIR FILTERS.** Page 145. No filter does all jobs, meets every need. That's why this company's filters are engineered to the job to offer more effective dust collection. This company's expanded metal face plate acts as a lint arrestor to provide easier cleaning and surfacing. It distributes air easily over the entire filter area. Bulletin available. .....Item 221

**PACKAGED LIQUID CHILLERS.** Page 122. Packaged liquid chillers for water or brine are made in sizes from 7½ to 200 hp. The units are factory assembled, tested, and shipped as one complete package. Bulletin containing specifications, features, and typical applications is available. ...Item 222

**PUSH-BUTTON HEATING.** Page 73. An automatic package steam generator is push-button controlled from a single station, mounted integral with the boiler. It operates with heavy or light oils, straight gas, or combination oil and gas. The generators are available in capacities from 2070 to 10,350 lb of steam per hour. Bulletin available. .....Item 223

**MECHANICAL LUNGS.** Page 156. Highly flexible in purpose or position, this backward blade centrifugal fan is designed for use in heating, ventilating, and air conditioning systems, power plant installations, and industrial processes. ...Item 224

**HIGH VELOCITY AIR SYSTEM.** Page 75. All-air high velocity units offer scientific air diffusion and are provided with an aspirating or high induction type air diffuser which is designed to diffuse air without drafts. Each unit can be pressure balanced by an easy-to-operate balancing device and a calibrated orifice. Selection manual available. .....Item 225

**REFRIGERANT INDICATORS.** Page 161. Advance design of these refrigerant indicators, which use a sight glass, keeps refrigerant losses to a minimum. Engineers dealing with fluid flow problems associate the name of these indicators with engineering assistance. A company representative will help in the choice of an indicator. Send for catalog .....Item 226

**STEEL PIPE.** Page 50. Steel pipe is stocked for fast service to you. Nearby distributors of this company's pipe carry a complete stock of good steel pipe and will deliver your order quickly. It saves you time delays on jobs and the expense of carrying costly, excess inventory. .....Item 227

**PUMPS.** Page 163. This company's pump mounts easily in limited space and in any position. Adjustable four-way discharge facilitates location of pump and of recirculation lines. Bulletin available. .....Item 228

**TANK GAGES.** Page 135. Remote reading tank gages feature trouble-free design, without pulleys, springs, or other mechanical gadgets, constant accuracy with large vertical scale with interchangeable scales readily removed or adjusted to correct for tank pitch. Gages can be installed easily on tanks above or below ground and up to ¼ mile away. Bulletin available. ...Item 229

**METAL FRAME PIPE RACKING.** Page 47. Heavy lines are easily supported on this sturdy metal framing. Clamps, concrete inserts, hangers, and rollers are among the many accessories for the framing. No welding or drilling is required to install it, and additions or alterations can be made at any time. A 78-page catalog is available showing how to rack, frame, suspend, and support mechanical and electrical equipment. .....Item 230

**FAN COOLERS.** Page 58. Eliminate water problems by using fan coolers for any size compressor, regardless of tonnage. Stands, hoods, and wind deflectors are available for simplified outside mounting. Bulletin available. .....Item 231

**ACID-RESISTING DRAIN PIPE.** Page 44. This drain pipe is made of high silicon iron alloy, which has a high resistance to corrosion, abrasion, and erosion. The pipe is installed by ordinary plumbing methods and can be counted on, in most cases, to outlast the building. Bulletin available listing details and standard fittings. .....Item 232

**VENTS.** Page 60. This company's line of vents includes three air vents and an air eliminator. These units, of float and thermostatic construction, express an unrivaled accumulation of knowledge in dealing with air venting problems. Catalog available. .....Item 233

**OIL LEAK DETECTION SYSTEM.** Page 157. An oil leak detection system continuously monitors the purity of condensate leaving steam-type fuel oil heaters. It protects the boiler by removing oil contamination from the feed-water cycle. The system is engineered to the special requirements of each installation. Details are available. .....Item 234

**VERTICAL DISCHARGE FAN.** Page 155. A vertical discharge fan can remove a large volume of fumes or air at high velocity. The fan is fabricated of zinc-coated iron sheet with welded construction throughout. Available as direct drive with motor mounted inside air stream or with motor mounted outside throat of ventilator. Catalog available. .....Item 235

**STEAM GENERATORS.** Page 67. Packaged steam generators, boiler-burner units, and industrial fuel burning systems are among the line of industrial steam generating and heating equipment offered by one manufacturer. The steam generators are made in two sizes from 15 to 30 hp and from 300 to 500 hp, oil or gas-fired or both. Specifications of the equipment are available. .....Item 236

**WALL CONVECTORS.** Pages 70-71. Wall convector heating systems are custom-made to meet modern architectural design and construction requirements. Enclosures are available in eight basic types for wall mounting or with integral sill, with either front or top outlets, and for single or double row heating elements. Details are available. .....Item 237

**LINE OF PUMPS.** Page 51. A line of pumps includes turbine, condensate, and vertical models. The turbine pump is used for automatically supplying water to a boiler when the boiler water is lost through steam in processing plants. Bulletins containing engineering data are available. .....Item 238

**INSULATED PIPING.** Page 74. Insulated piping systems are prefabricated by a firm with 45 years in the insulated piping field. The systems are available for both overhead and underground use. Technical information is available in a catalog. .....Item 239

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FIRST CLASS PERMIT NO. 38, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

**AIR CONDITIONING, HEATING AND VENTILATING**

93 WORTH STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE

**TEMPERATURE REGULATOR.** Page 145. A self-operating temperature regulator that automatically holds temperature constant at the right point prevents losses caused by over-heating. The regulator is available with various valve bodies and inner valves and temperature ranges of 60 deg. F. It controls the flow of steam, water, gas, or other fluids. Bulletin available. .....Item 240

**AIR CONDITIONING COILS.** Page 150. Air conditioning and refrigeration coils of all types have been produced by one manufacturer for 43 years. Among the company's line of equipment are a pie plate coil, a flash cooler, a walk-in cooler fin coil, an air-cooled condenser, a fin coil, and an air conditioning unit. Catalogs and price lists are available. .....Item 241

**PIPE INSULATION.** Page 13. Pipe insulation can be cut with an ordinary knife on the job to form elbows, straightaway runs, and odd shapes for equipment, fittings, and ducts. The insulation is moisture-resistant and dimensionally stable. It is also available in panels. .....Item 242

**COPPER WATER TUBE.** Page 127. Copper water tube, 23,960 lb. of it in sizes from ⅛ to 5 in., was used for the plumbing lines in a new senior high school. Copper water tube is available for radiant panel heating, hot and cold water lines, underground service lines, processing lines, waste lines, and vent stacks. Technical advisory service is available. .....Item 243

**MOISTURE CONTROL.** Page 151. Controlled humidity is provided by an air conditioning unit that has its cooling and heating functions completely separate from adding or taking away moisture. The unit operates at normal atmospheric temperatures and needs no summer reheat. Bulletins are available. .....Item 244

**PROPELLER-FAN UNIT HEATERS.** Page 11. Propeller-fan unit heaters for steam or hot water are rated within the four lowest sound classifications. The units have heating elements of flat, plate-type fins and U-bend coil construction. They are available in 8 basic sizes and 24 models ranging from 15,000 to 235,000 Btu per hr. Literature is available. .....Item 245

**RADIANT BASEBOARD.** Page 25. A radiant baseboard for residential and institutional use has a coil support bracket and cradle. The coil cradle fits to the fins of the coil to prevent movement in the cradle and moves with the coil during expansion and contraction of the coils in use. The support bracket is so designed that the faceplate of the baseboard snaps firmly to it. Information available.....Item 246

**PLUG-TYPE VALVES.** Page 29. Plug-type valves for throttling steam are made with a 500 Brinell, stainless steel seat for maximum resistance to galling, cutting, abrasion, and erosion. The stainless steel plug is securely fastened to the spindle with a bronze locknut. The valves are available in globe and angle in 150, 200, and 300-lb. sizes. Information available. .....Item 247

**AIR CONDITIONING EQUIPMENT.** Page 142. Air conditioning equipment manufactured by this firm includes water savers, blower units, sprayed coil dehumidifiers, multi-zone units, cooling towers, liquid chillers, and evaporative condensers. Catalogs describing each type of equipment are available. .....Item 248

**FIN-TYPE RADIATION.** Pages 42-43. Baseboard, wall, and cabinet convectors with fin-type radiation are designed for wall to wall applications in schools, office buildings, hospitals and institutions. Overall cabinet types are 14, 20, and 26-in.; depths are 4 and 6 in.; and lengths are made to 72 in. Information available. .....Item 249

**VENTING VALVES.** Page 45. Venting valves for either one-pipe or two-pipe steam, hot water, residential or industrial heating are included in this company's line of valves. Adjustable-port valves are also available for vacuum and non-vacuum systems. The radiator valve has a hinged drainage tongue. .....Item 250

**ADJUSTABLE AIR DIFFUSERS.** Page 40. Spun aluminum air diffusers can adjust the volume and pattern of air flow after installation. Round, square, and slot-type air diffusers are made to meet all architectural requirements. Specifications of the diffusers are available in a data book. .....Item 251

**STEAM GENERATORS.** Page 17. Steam generators that encompass a complete line of packaged boilers are available in fire-tube types to 600 boiler hp and in water-tube types to 45,000 lb. per hr. Two catalogs are available giving complete details on each type of generator. .....Item 252

**EXHAUST FANS.** Page 2. Roof exhaust fans help to maintain ideal air conditions in a new Miami Beach hotel. These fans are also used to ventilate commercial and public buildings. Bulletin describing the fans is available. .....Item 253

**MULTI-ZONE AIR CONDITIONING.** Page 48. A single unit can replace several by providing simultaneous air conditioning of separate rooms or zones at desired temperatures. The units are advantageous where the problem of fluctuating cooling and heating loads exists. The units are made in capacities from 2,500 to 24,000 cfm. Bulletin with complete information is available .....Item 254

**CENTRIFUGAL PUMP.** Page 27. Centrifugal pumps are designed and built to operate quietly in forced, hot water heating systems. They are available in a complete capacity range for apartments, institutions, commercial, and industrial buildings. The pumps can be serviced without breaking pipe connections. Pump catalog is available. .....Item 255

**COPPER PLUMBING.** Page 57. One hundred thousand pounds of copper tube, ranging in size from ⅛ to 12 in., is used in the hot and cold water lines, sanitary drainage systems, and roof drainage lines of a 43-story building. Standard 20-ft. lengths eliminate many joints, and solder-type fittings make it easier to adapt the system to the needs and limitations of the building. Descriptive literature is available. .....Item 256

**Use this digest to locate and refer to advertisements appearing in this issue of AIR CONDITIONING, HEATING AND VENTILATING, then fill out and mail the prepaid postcard to request further information.**

**HEATERS AND COOLERS.** Page 4. Among this company's line of heat exchangers are tank suction heaters, oil pre-heaters, condensate coolers, storage water heaters, and instantaneous water heater and convertors. The company also builds heat exchangers to customers' requirements, such as: lube oil coolers, suction oil heaters, pre-water heaters, boiler blow-down heaters, and many others .....Item 257

**PACKAGED AIR CONDITIONERS.** Page 56. Ten models are available from this manufacturer's line of packaged air conditioners both waterless and water-cooled. The waterless units are made in capacities from 2 to 7½ hp; the water-cooled are made in six models from 2 to 18 hp. The company's factory, field representatives, and distributor are ready to lend a hand. Information is available. .....Item 258

**VENTILATING SETS.** Page 31. Utility-type ventilating sets are made in a selection of sizes, belt- or direct-driven, that are adaptable to standard size heavy-gage aluminum shutters. They are available with or without motor and drive covers and in any rotation or discharge. Catalog with rating and dimension charts is available. .....Item 259

**HEAT DIFFUSERS.** Page 158. Unit heat diffusers can be used for many industrial or commercial applications to distribute heat evenly at full or partial loads. Their sectionalized construction permits floor mounting, or vertical or horizontal suspension. They are made in sizes and arrangements for 20,000 to 1,620,000 Btu per hr.; 15,000 to 21,000 cfm. Folders and selection data are available. .....Item 260

**STEAM CONTROLS.** Page 161. Steam controls for use on all stoker, gas- or oil-fired boilers proportion fuel and air feed and reduce smoke, soot, and fly ash. The controls may be used with single or multiple boiler installation. Details of the controls are available. .....Item 261

**CONVECTOR HEATING.** Pages 42-43. Along-the-wall convectors can be flush mounted one, two or three tiers high, the convectors can be used for steam or hot water and are available with steel or non-ferrous elements. The heating elements are hung on a support that is attached to a hanging strip on the wall. The fronts, and backs, and lever-operated damper can be easily cut on the job. Bulletin available. .....Item 262

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# Ad-Digest SERVICE

**FAN EVERULATION CATALOG.** Page 1. A catalog describing in detail the direct way in which to exhaust fumes is offered by a fan manufacturer. The catalog gives definitions and fan laws; tells how to determine static pressure; and contains a velocity pressure table, a friction chart, and a loudness level table. Copies are available. .....Item 263

**DUCT INSULATION.** Page 34. Thermal, acoustical, and vapor barrier problems can be solved by long, glass fiber duct insulation. Ducts formed in this way are completely insulated units, ready to install on the job. No vapor barrier is necessary with the insulation on the inside of the duct. .....Item 264

**HOT WATER HEATERS.** Page 131. A 1200-gal. capacity, cement-lined, hot water storage heater in a dairy heats 5400 gph from 40 deg F to 180 deg using steam at 100 lb. pressure. The cement lining fortifies the outer steel shell against corrosion. Available in capacities from 120 to 10,000 gal., the heater meets all ASME specifications. Hot water heater bulletin is available. .....Item 265

**LINE OF AIR DIFFUSERS.** Page 164. Air diffusers for every application in this manufacturer's line include: cooling, cooling and heating, supply and return, half-round, rectangular, and square. The diffusers are adjustable for air volume and diffusion pattern. Air diffuser catalog is available. .....Item 266

**VALVES AND REGULATORS.** Page 166. One of the largest lines of regulators includes: relief valves, reducing valves, steam heating specialties, hot water heating specialties, and protective devices. Literature describing the entire line is available. .....Item 267

**VANEAXIAL FANS.** Page 69. A West Coast quick-freezing plant utilizes twenty-four 7½-hp vaneaxial fans, installed in two groups of twelve each. At full plant load, each 12-fan battery handles 242,000 cfm of sub-zero air between —20 deg and —35 deg F. The fans have in-line construction and adjustable blades. .....Item 268

**GALVANIZED STEEL.** Page 30. Whether it is complicated work for special purpose or an everyday duct job, there is galvanized steel to help you do it quicker and better. The coating on this galvanized steel forms readily, looks better, and resists both peeling and flaking. ....Item 269

**GAGE HOLDERS.** Page 157. Magnetic mounting clips, which slip on 1-in. thick, portable inclined gages, magnetically hold draft gages and U-tube and inclined manometers to steel surfaces such as ducts. By freeing both hands, the holder permits one man to do the job of two. Trial set and bulletin are available. .....Item 270

**PLUMBING FITTINGS.** Page 19. Mounting off-the-floor plumbing fixtures on behind-the-wall fittings and carriers permits a high degree of restroom sanitation to be attained and maintained in the rooms that everybody sees. All stresses are carried by the fittings and none by the wall to make it simple and easy to install, align, and replace plumbing fixtures. Booklet on restroom design is available. .....Item 271

**ROOF VENTILATORS.** Page 151. Forty-nine 48-in. aluminum, low-type roof ventilators are used to maintain a pleasant working atmosphere and remove oil mist from a screw machine products plant with 200,000 sq ft of floor space. Twenty-five of the ventilators supply air; the remainder function as exhaust ventilators. Ventilating databook is available. .....Item 272

**REFERENCE CATALOG.** Page 153. A 24-page reference catalog for those who specify, order, or buy: hot or cold water storage tanks; air receivers, flash, surge, condensate, and blow-off tanks; and hot water generators or heat exchangers is offered by one manufacturer. The catalog contains special sections on alloys, clads, and a variety of linings. Write for catalog on company letterhead. .....Item 273

**LOW WATER CUTOFF.** Page 15. Both steam boilers and hot water boilers encounter the same low water troubles and the expense it can cause. Today, many insurance companies, local codes, and federal specifications insist on the same kind of protection for hot water heating boilers. A feed cutoff combination provides that protection. Folder with facts about low water in hot water boilers is available. .....Item 274

**AIR CONDITIONER INSULATION.** Page 30. One company's glass fiber insulation is used in a new 2-ton air conditioner because of its high thermal efficiency and because it is an effective sound absorber. Among its other advantages are its light weight, its low space requirement, and the fact that it resists settling, fire, and moisture. Insulation literature is available. .....Item 275

**HORIZONTAL AIR CONDITIONER.** Page 22. Horizontal, remote-type units that heat, cool, filter, and recirculate air are made in three models and four sizes with 300, 360, 480, and 600 cfm capacities. Measuring 8½ to 10¾ in. high, the units operate with heated or chilled water supplied from a central plant through a compact piping system. Information on the line of horizontal air conditioners is available. .....Item 276

**FLEXIBLE DUCT CONNECTORS.** Page 154. Flexible duct connectors can be made on the spot in minutes with factory-assembled, metal-to-material units that unroll flat. A choice of UL-approved canvas, asbestos, and Neoprene-coated fiber glass in 3 to 6-in. widths attached to 24 or 28-gage galvanized steel or 24-gage aluminum is available in 25, 50, or 100-ft rolls. Catalog and specification sheet are available. .....Item 277

**CROSS-FLOW COOLING TOWERS.** Page 41. Cross-flow cooling towers in the intermediate capacity field are backed by years of selective development. The towers are supplied with either asbestos cement board or steel casings in 60, 80, or 100 ton capacity. The steel cased units are shipped in three sub-assemblies that reduce construction time. .....Item 278

**ROOF VENTILATORS.** Page 14. Twenty-two roof ventilators, ranging in size from a 520-cfm unit to a 23,000-cfm unit, exhaust a total of 119,000 cfm from a suburban department store with 200,000 sq ft of floor space. The fan's motor is out of the air stream, and the entire unit is shipped ready to install to the duct system. Direct drive units are available from 150 to 11,000 cfm; belt drive units from 2500 to 45,000 cfm, developing static pressure to 4 in. Information available. .....Item 279

**HIGH VELOCITY AIR VALVES.** Page 58. High velocity air valves are used in air conditioning systems at branch duct takeoffs to deliver low velocity air to branches from high velocity trunk ducts, with all diffusers on each branch served by one air valve. Comprehensive performance data and design information for engineers are available in a bulletin. .....Item 280

**OIL UNIT HEATERS.** Page 145. Eight oil-fired unit heaters installed in a large, drafty farmer's auction market heat the market in an hour. They run on No. 2 fuel oil and have adjustable louvers that direct the heat where it is needed without cold spots. Unit heater catalog is available. .....Item 281

**STEAM DISTRIBUTING TUBES.** Page 13. Trombone-shaped tubes for steam distribution serve two adjacent condensing tubes from a single supply header connection. The smallest amounts of steam are made to travel twice as far across the coil length and to contact twice the surface area. The tubes are made in two sizes, one and two row depths, aluminum or copper fins, in finned lengths from 12 to 120 in. Publication is available. .....Item 282

**BURNER FOR HEAVY OIL.** Page 137. A burner for heavy oil has an electric valve controlled by the oil temperature that will not admit oil to the atomizing cup until it has reached a desirable burning temperature. Heated oil not required for immediate firing is returned to a storage tank; the entire operation is automatic. Literature and specification sheets are available. .....Item 283

**STEAM BOILERS.** Page 159. Two oil-fired steam boilers have been selected to provide a total steam capacity of 10,000 lb per hr for a sea-going radar platform. Made for industries, utilities, institutions and other users, the shop-assembled boilers are available in standard sizes for steam loads ranging from 2000 to 40,000 lb per hr at pressures to 225 psi. .....Item 284

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FIRST CLASS PERMIT NO. 52, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

AIR CONDITIONING, HEATING AND VENTILATING

93 WORTH STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE

# Dollars you save with this NEW, LOW-COST POWER

## FOR DOMESTIC APPLIANCES AND ACCESSORIES ON AUTOMOBILES • BOATS • AIRCRAFT

Now, power accessory manufacturers can take advantage of the low cost and extreme versatility of this new Redmond MicroMotor. Designed for use on various domestic appliances as well as for automobile window lifts, seat adjustors, windshield wipers, air conditioners, and marine pumps and blowers, this new motor is wound for both direct and alternating current.

The TW motor is available in sizes from 1/100th h.p. at 1500 r.p.m. to ¼ h.p. at 15,000 r.p.m.

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THE BIG NAME IN SMALL MOTORS

# You can have DRY AIR with exact moisture control..

*Assembling Electronic Parts*

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FOR YOUR PROCESS
FOR TESTING MACHINES OR MATERIALS AT ANY TIME OF THE YEAR

*Packaging Food Products*

*Drying Industrial Material*

● This Niagara "Controlled Humidity" method gives you the **MOST EFFECTIVE** Air Conditioning because its cooling and heating functions are made completely separate from adding or taking away moisture. This assures you always a precise result. No moisture sensitive instruments are needed.

**MOST FLEXIBLE.** You can reach and hold any condition in response to instrument settings, or vary it as you wish.

**EASIEST TO TAKE CARE OF.** The machine is accessible, the control circuits are simple and easy to operate, and there are no solids, salts or solutions to be handled.

**MOST COMPACT.** It does a very large amount of work in a small space.

**INEXPENSIVE TO OPERATE.** At normal atmospheric temperatures (unlike systems that use refrigeration to dehumidify) it needs no summer re-heat.

*Write for Bulletins 112 and 122*

## NIAGARA BLOWER COMPANY

Dept. HV, 405 Lexington Ave. New York 17, N. Y.

*Niagara District Engineers in Principal Cities of U. S. and Canada*

## CONSTRUCTION REVIEW

(*Continued from page* 146)

ings. Last year, such buildings accounted for 29% of all non-residential building, as compared with 25% this year. However, this is still a very high level, considering that as recently as 1946, educational buildings were 7% of non-residential.

• **HOSPITALS.**—Hospital awards at $280 million represented an increase of 12% above last year, but were still well below the peaks set in 1950 and 1951.

• **CHURCHES.**—A further great increase in contracts for religious buildings in 1955 brought them to fourth place among non-residential buildings, exceeded only by commercial, manufacturing, and educational buildings. The total of $285 million represents a new record 28% above last year, marking the continuation of an almost unbroken period of growth since World War II. Religious building contracts in the first half of this year are more than 670% above the corresponding period of 1946.

• **PUBLIC WORKS.**—Awards for public works totalled $1.7 billion, a new record 25% above the previous record set last year. Highway construction at $1.125 billion was 42% ahead of last year, for a new record, and all other categories of public works except bridges were well ahead of last year.

• **UTILITIES.**—Contract awards for construction of private and public utilities totalled $685 million, some 38% ahead of last year and well above the first-half record established in 1952. All categories were up except gas plants and a small miscellaneous group.

• **SIGNIFICANCE.**—Since construction contract awards precede actual construction, the extremely high levels reported in the first half of 1955 indicate that construction activity in the second half of the year will remain very high, and that the year will almost certainly establish a new record for construction put in place.

One of the most striking features of the situation is the broad base of the increased activity, including nearly all classes of residential and non-residential building and engineering.

There has been, in recent months, no indication of a downturn underway. In June, the latest month, total awards were 30% ahead of June, 1954, exactly the same as the increase for the whole 6-month period and far above the 13% increase of May, 1955 over May, 1954.

It would be unwise to expect such large percentage increases over previous years to go on indefinitely without some abatement, Dr. Smith cautioned. However, there is nothing in the figures available to date to indicate that any slackening of the rate of increase has developed as of mid-1955.

## ATOMIC HEATER

**for homes predicted by IBR spokesman. Baby reactor carries 6-year fuel charge for $300.**

An atomic year-round home heating-cooling system—powered by a baby nuclear reactor hooked-up to a conventional boiler—was forseen by industry spokesmen as a practical reality possibly within a few years. The system will both heat and cool the home for approximately 6 years on a single charge of fissionabll material hermetically sealed within the multiple-shielded "portable" reactor. Cost for the 6 year charge is estimated at about $300. About twice the size of an auto battery, the reactor would be replaced with another sealed unit at the same price after its charge has been exhausted.

The A-Boiler system—which can be added to existing home heating boilers without removing them—will provide the home with chilled water cooling in summer, hot water heating in winter, virtually unlimited year-round household hot water, and heat for melting snow from walks and driveways.

The announcement was made by Robert E. Ferry, general manager of the Institute of Boiler and Radiator Manufacturers at its 40th Anniversary Meeting.

• **SOURCE.**—Quoting industry experts, including Frank L. Phillips, New York consulting engineer with wide experience in heating and air conditioning and Atomic Energy Commission projects, Mr. Ferry pointed out that the chief foreseeable problem holding up availability of the A-Boiler system is the need for adequate supplies of fissionable material at economic cost. As for engineering knowledge of design, material and shielding of the baby reactor, this appears to be no longer a problem.

• **VERSATILE.**—Summer cooling in homes by the A-Boiler system would be accomplished by addition of a small absorption refrigeration unit, which operates on heat from the reactor. Water chilled by the unit would be piped to forced convectors or dual baseboards to cool the home. In winter, the same sealed piping circuits would carry hot water, as in a modern conventionally fueled hot water heating system.

• **INSTALLATION.**—The A-Boiler system may be installed either by converting present home heating boilers, or, as a new integrated unit combining reactor, heat exchanger, and boiler in one package. Approximate cost for converting existing boilers is estimated at $1000. A completely new integrated installation is estimated at approximately $1500. In a new house, however, savings would result from eliminating flues and chimney. Once installed, the sole fuel expense thereafter would consist of recharging every six years or so by exchanging the exhausted reactor for a fresh one, factory adjusted, sealed and pre-controlled. Life of the system equipped with a cast iron boiler would run to 40 or more years.

Any possibility of explosion, it was noted, within the reactor would be completely eliminated since critical elements necessary for chain reaction would not be present in the fissionable material.

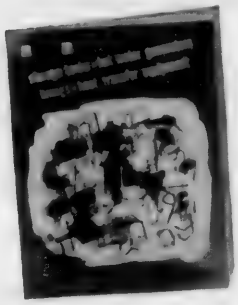
## SOLAR CONFERENCE

**will review scientific basis of applied solar energy as prelude to world symposium in Arizona.**

An international conference on the scientific basis of applied solar energy will be held at the University of Arizona, Tucson, October 31 and November 1 as a pre-

(*Continued on page* 154)

# ATTENTION!



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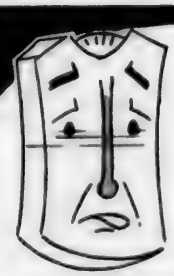

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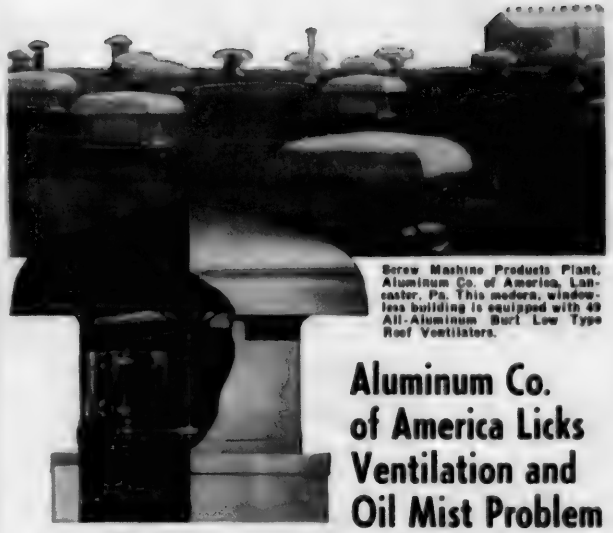

Screw Machine Products Plant, Aluminum Co. of America, Lancaster, Pa. This modern, windowless building is equipped with 49 All-Aluminum Burt Low Type Roof Ventilators.

## Aluminum Co. of America Licks Ventilation and Oil Mist Problem with Burt Low Type Ventilators!

**THE PROBLEM**

The modern building design selected for Alcoa's new Screw Machine Products Plant is practically free of wall openings. Its 200,000 square feet of floor space has no cross circulation or natural ventilation. Production operations create considerable heat and oil mist.

**THE SOLUTION**

Forty-nine 48" all-aluminum Burt Low Type Roof Ventilators are used to maintain a pleasant working atmosphere the year around. Oil mist is scarcely discernible. Twenty-five of the Burt ventilators supply air. The remaining twenty-four function as exhaust ventilators.

**COMPARATIVE COST**

The high volume air supply utilized here is relatively inexpensive. According to the Alcoa Staff Engineer for Air Conditioning, the initial cost of air supplied by the Burt Low Type Roof Ventilators is less than one-fourth that of a centralized duct system.

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If you are looking for fresh air at low cost, investigate Burt's complete line of modern, efficient roof ventilators.

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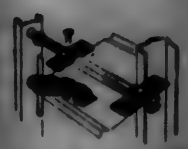

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## SOLAR CONFERENCE

(*Continued from page* 152)

lude to the World Symposium on Applied Solar Energy to be held in Phoenix November 2-4.

Both the Tucson and Phoenix meetings will be jointly sponsored by the Association for Applied Solar Energy, Stanford Research Institute an the University of Arizona.

• **WORLDWIDE.**—Scientists from many countries are expected to attend the Tucson conference to exchange ideas on fundamental principles involved in the application of solar energy. They will then move on to Phoenix to discuss the technological aspects of the practical utilization of solar energy with world-wide representatives of industry, agriculture, finance and education.

One of the major objectives of the meeting at the University of Arizona will be to assist scientists in charting the direction of future research. The conference will permit free discussion of the scientific bases upon which the utilization of solar energy is founded. Following a general session, three sections will convene to discuss thermal, photochemical and electrical processes for converting the sun's enery to man's use.

• **PROGRAM.**—Dr. Richard N. Thomas of Harvard College Observatory will open the general session in Tucson on the morning of October 31 with a discussion of "The Features of Solar Energy as Imposed by the Physics of the Sun."

Dr. Sigmund Fritz of the U. S. Weather Bureau will describe the geographic distribution of solar energy, with special reference to systematic programs of observation.

Dr. Farrington Daniels of the Department of Chemistry, University of Wisconsin, will review the principles and problems of research in the utilization of solar energy.

Three special sessions will be held concurrently on the afternoon of October 31 and the morning of November 1, Dr. Everett D. Howe, chariman of the Department of Mechanical Engineering and assistant dean of the College of Engineering at the University of California, Berkely, will serve as chairman of the section on thermal processes.

Co-chairman of the section on photochemical processes will be Dr. C. S. French and Dr. H. W. Milner of the Stanford, Calif., laboratory of the Carnegie Institution of Washington. In a discussion of large-scale algae culture, Dr. Milner will lead a session on relevant aspects of algal physiology and Dr. French will chairman a session on practical considerations of algae culture.

A session on photo-chemistry of the higher plants and non-biological systems is also scheduled, with the chairman to be announced later.

A third section of the university conference will deal with electrical processes, under the chairmanship of G. L. Pearson, research physicist at Bell Telephone Laboratories, Murray Hill, N. J.

The university meeting will conclude with luncheon on November 1. Conference members will go to Phoenix by chartered bus that afternoon for the three-day program of the world symposium there.

The Ford Foundation of New York has made a grant of $26,500 to Stanford Research Institute to assist the

(*Continued on page* 156)

## For removing a LARGE VOLUME of Fumes or Air at HIGH VELOCITY

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VERTICAL DISCHARGE FAN

Whenever you face the problem of discharging fumes or vapors through a roof ventilator so that they will not short circuit back through building openings, you'll find the solution in this new Vertical Discharge Fan. It is designed especially for industrial applications that require the removal of a large volume at high velocity. The "VD" roof fan is fabricated of zinc-coated iron sheet with welded construction throughout. Automatic wing dampers open with air blast, close weathertight when not operating. The "VD" is available as direct drive with motor mounted inside air stream or as "VDR" with motor mounted outside throat of ventilator. Either type is available in a wide range of capacities and sizes.

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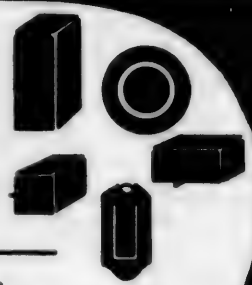

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Tank Gauge offers you the convenience of Remote Reading plus these four extra features:

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**CONSTANT ACCURACY** • • • The large vertical scale on the Petrometer gives you constant, accurate readings. The red liquid column is clearly visible—moves up and down as contents vary, just like the liquid level in your tank.

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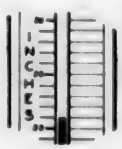

**INTERCHANGEABLE SCALES** • • • The scale on the Petrometer is readily removed or adjusted to correct for tank pitch or when changing liquids. No tools are needed.

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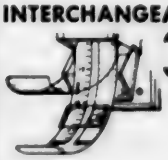

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## SOLAR CONFERENCE

(*Continued from page* 154)

participation of foreign scientists and engineers in the World Symposium on Applied Solar Energy next November. More than 50 scientists from 30 foreign nations will be able to participate in the meeting through the contributions of the Ford Foundation and other funds.

## AIR POLLUTION DEVELOPMENTS

**summarized in roview of state and local actions to curb gas discharge by industry and vehicles.**

A proposed new air pollution abatement regulation that would require operators of certain heating equipment in New York City to install smoke recording apparatus was opposed by business associations and others at a hearing conducted June 22 by the City Air Pollution Control Board.

No final action was taken by the board on the proposed regulation, which would require operators of boilers using residual oil or bituminous coal to install smoke-recording devices when they have a record of one air-pollution violation. The device would indicate when a boiler is polluting the atmosphere, so an operator could take corrective action. The operator would be required to have the records available for inspection.

• **ATTACK.**—Spokesmen for the Commerce and Industry Association of New York, the Real Estate Board of New York, and the Association of Industrial Oil Burner Contractors assailed the plan in separate statements.

Experience with smoke-recording equipment, they said, indicated it was inaccurate, could easily be tampered with, and was expensive. Installation was said to cost up to $200.

Speaking for the heating contractors' group, Milton Way further declared: "We must urgently object to a rule or regulation of any departmental agency which places upon a citizen obligations to furnish evidence to an enforcement agency that may result in conviction for violation of a law."

• **BUSES.**—Also attacked were proposed regulations aimed at reducing the flow of noxious fumes from buses. One proposed rule would require a device on gasoline-fueled buses for reducing the fumes. Of nearly 6,000 buses in New York City, 849 are gasoline-fueled, and of these 356 are equipped with anti-fume mechanisms.

Two other proposed rules also are directed at reducing exhaust gases. One would limit to three minutes the time a bus may remain stationary with its engine running. The other would make it a violation for a bus to emit smoke while standing still, or while proceeding a distance of more than 100 yards.

Dr. Leonard Greenburg, chairman of the control board, said his agency was attempting to combat air pollution from motor vehicles before the situation became acute. He warned New York could be faced with the same air pollution problem that has affected Los Angeles County in California.

He said the regulation, for the present, would not cover

(*Continued on page* 158)

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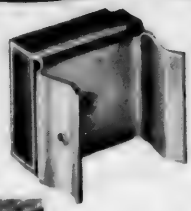
...WITHOUT HOLDING IT!

**Dwyer MAGNECLIPS**
CONTROLS GAGES

*magnetically hold gages to any steel surface*



DWYER Magneclip shown about ½ actual size

- mount instantly
- grip securely (15 lbs.)
- free both hands
- protect gage

Dwyer Magneclips—magnetic mounting clips—slip on all 1-inch thick portable inclined gages. Clips simply slide on . . . spring action keeps them in place. Drilled on one side and complete with self-tapping screw for the 1211 series Slack Tube, No. 1210, 1215 and 1230 Flex-Tube Manometers. Per Pair . . . $2.50

One Magneclip holds U-Tube Manometer to duct for positive easy velocity reading (with Dwyer Pitot Tube).

Two Magneclips level and hold Inclined Manometer to a hard to reach overhead duct. One man does a former "two-man" job.

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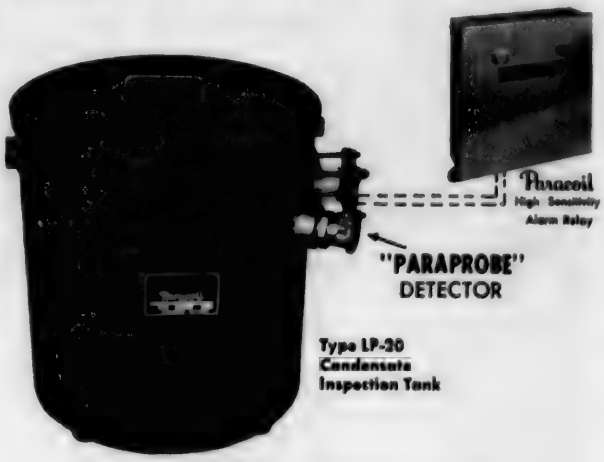


**Continuously Monitors the Purity of Condensate leaving Steam-Type Fuel Oil Heaters**

- **Isolates all fuel oil entrained in the condensate stream**
- **Gives alarm to plant Personnel**
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- **Applicable to both low and high pressure steam plants**
- **Engineered to the special requirements of each installation**

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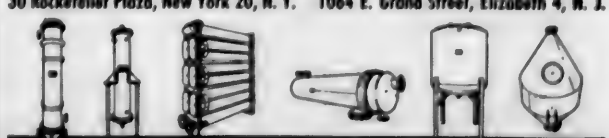

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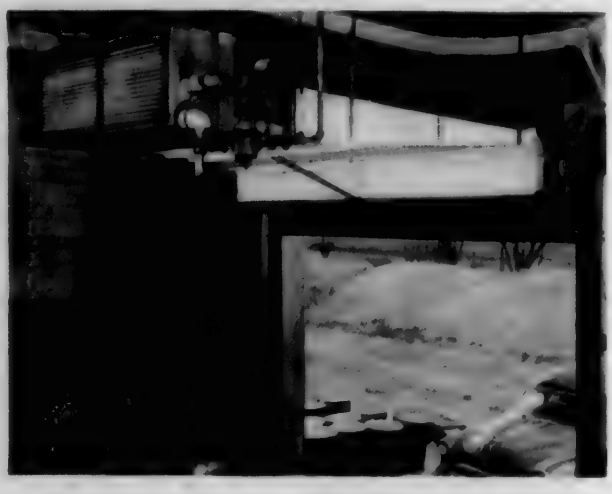

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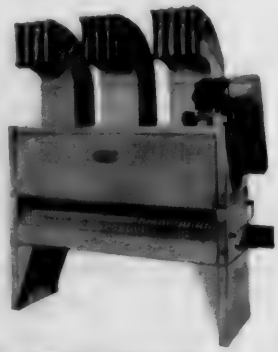
**This compact, versatile unit "blankets" door openings with a wall of warm air. Unique down-flow, warm-air outlet can be installed to extend across the top of the door. A full-width air blanket blasts warm air all the way to the floor. Unit can be thermostatically controlled to operate only while door is open. It keeps cold out, prevents drafts and saves fuel. It is ideal for open shipping doors. Sectionalized construction makes installation easy.**

**Carrier Heat Diffusers can be used for many other applications, industrial or commercial. They distribute heat evenly at full or partial loads. Positive control of heat saves fuel through flow control of steam or hot water, or damper control of air. Sectionalized construction permits floor mounting, vertical or horizontal suspension. Sizes and arrangements for 80,000 to 1,620,000 Btu/hr; 1500 to 31,000 cfm.**



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## AIR POLLUTION DEVELOPMENTS

(*Continued from page* 156)

diesel-powered buses since no satisfactory device to control their smoke has been developed.

"But we will go to work on diesels and try to do something about them, too," he promised, "as soon as the nuisance of smoke from gasoline-driven buses has been brought under control."

Dr. Greenburg explained that the device needed for reducing or eliminating smoke from gasoline-driven buses was a "vacuum-breaker" on the intake manifold to prevent gasoline vapor from being sucked into the manifold when the bus decelerates. The device, a spring-activated valve, is about two inches long and one and a half inches in diameter. It costs from $25 to $50 to install.

Other new developments in the field of air pollution abatement, as reported from state capitals and cities throughout the country, include the following:

• **ARIZONA.**—Failing of enactment in the Arizona legislature was a bill which would have given the State Health Department statewide authority to tackle the air pollution problem. It would have empowered the department to declare a polluting agency or industry a public nuisance and to take action to stop the pollution, by court injunction if necessary.

• **CALIFORNIA.**—Some 34 bills aimed at curbing air pollution were introduced in the California legislature, but most of them were rejected.

One of the enacted bills appropriated $104,000 to the University of California for air pollution research.

Another enactment added "air pollution" to the list of natural disasters such as flood, fire and earthquake. It will permit the declaration of extreme emergency under the California disaster act when needed.

Measures not reported enacted included a bill which would have established a state air pollution control board and five regional boards.

• **NEVADA.**—Officials of Washoe County and the cities of Sparks and Reno discussed at a June meeting the advisability of adopting a common smoke control ordinance. Representatives of the two cities said they would take the matter up with their respective city councils.

• **NEW HAMPSHIRE.**—A bill passed by the New Hampshire House of Representatives and sent to the State Senate would extend tax exemption to industries that cooperate in the installation of facilities to curb air and water pollution.

• **NEW JERSEY.**—A bill enacted by the New Jersey legislature authorized the Interstate Sanitation Commission to make a study of air pollution in the New York-New Jersey metropolitan area and appropriated $30,000 to underwrite half the costs. An identical bill and appropriation was enacted earlier by the New York legislature.

The New Jersey bill was sponsored by Assemblywoman Florence P. Dwyer, Union County Republican, who proposed that the study include a survey of the sources and extent of air pollution, property damage caused by it, its effect on public health and comfort, and relevant meteorological, climatological and topographical factors. The measure directed the commission to report before Feb. 1.

(*Continued on page* 160)

B&W FM BOILERS GO TO SEA TO SERVE . . .

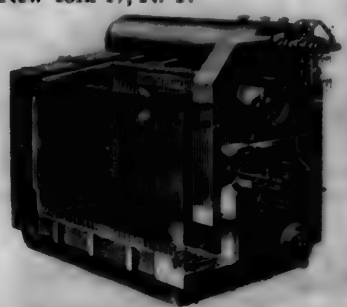
# Another Watchdog for 165 Mi

Soon to rise out of the sea, this "Texas Tower" will stand on the continental shelf along the Atlantic coast. One of a number of unique radar platforms planned to strengthen national defense in the Air Defense Command's mission of defending the United States against possible enemy air attack, it will be installed in relatively deep water. The platform, housing billets, mess facilities, equipment and [illegible] area will be well above the highest waves expected at the site. [illegible] the weather deck will be available as a helicopter landing area.

Out in the open sea, an installation of this importance must [illegible] steam generators that are completely reliable and efficient. The [illegible] that two oil-fired B&W Boilers, Type FM have been selected to serve this unusual installation, is a tribute to their established reputation for dependable service. Having a 10,000 lb per hr total steam capacity, these units are equipped with electrical controls and safety features, are completely automatic, and require very little supervision. Operated alternately, each FM will individually carry the full steam load for heat, hot water, laundry, and cooking requirements.

In going to sea for this special job, B&W FM Boilers join all the B&W Marine Boilers supplying steam for both commercial and naval vessels. With a record of dependable and economical service to industries, utilities, institutions, and other users, FMs are now serving in virtually every category requiring steam. An indication of their widespread application is their total steam capacity, in service or on order, of more than 11,000,000 lb of steam per hr. More than half of this capacity is in space-saving multiple-unit installations.

Compact, versatile, the shop-assembled FM is available in standard sizes for steam loads ranging between 2900 and 40,000 lb per hr at pressures to 235 psi—is widely used for higher pressures and with moderate superheat. Whether your requirements are unusual or conventional, we'll be pleased to show you how the FM Boiler can help reduce the cost of your steam. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.



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## AIR POLLUTION DEVELOPMENTS

(*Continued from page* 158)

The new measure supplements legislation enacted last year in New Jersey creating a commission to study the intrastate aspects of air pollution. This agency is entitled to draw on a $25,000 appropriation to the State Health Department and to utilize personnel of that department versed in air pollution.

• **NEW YORK.**—Failing of enactment in the New York legislature was a proposal to set up a seven-member State Air Pollution Control Board within the State Public Health Department and with the state health commissioners as chairman.

Under the unsuccessfully proposed legislation, the board would have been empowered to abate, control and prevent air pollution and to formulate uniform rules throughout the state, and to organize county associations.

• **SOUTH CAROLINA.**—A bill failing to win passage in the South Carolina legislature would have permitted cities or counties to set up air pollution control boards which, after public hearings, could order abatement of noxious industrial smoke, chemicals, dust and other pollutants.

The measure was sponsored by Representative LeaMond of Charleston, who said he wanted the state, rapidly becoming industrialized, to be ready to prevent any smog situations such as have occurred in Pittsburgh and Los Angeles.

• **WISCONSIN.**—Defeated in the Wisconsin legislature was a bill which would have added noxious substances and offensive odors to the list of items which Milwaukee County could regulate under its air pollution ordinance.

## SOLAR FURNACE

**develops 6,044 deg F at New York's Fordham U. Made from Army surplus searchlight mirror.**

New York City's first solar furnace melted a bit of cold Manhattan granite in three seconds on June 28.

• **REFLECTOR.**—The device, which employs a sixty-inch parabolic mirror to trap the sun's infra-red waves, was demonstrated on the campus of Fordham University, where chemists fashioned it from a surplus Army searchlight.

Dr. Tibor S. Laszlo, its designer and the director of Fordham's high-temperature laboratory, said the furnace had been able to develop a temperature of 6,044 degrees Farenheit, about half the surface temperature of the sun. With mechanical improvements and a 120-inch mirror planned for construction this fall, he hopes to attain 9,000 degrees.

• **HOT SPOT.**—Unlike solar ovens, which are being used experimentally to harness the sun's energy. Dr. Laszlo's furnace was planned to collect a maximum of heat for concentration in a small area. Test materials are melted or even boiled in one spot about the size of a dime. Their physical and chemical properties at high temperatures can then be studied.

In the solar furnace, it was shown, only a small spot

(*Continued on page* 162)

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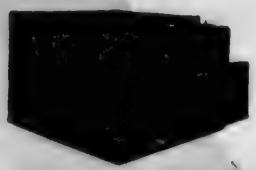

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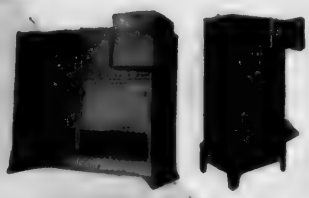

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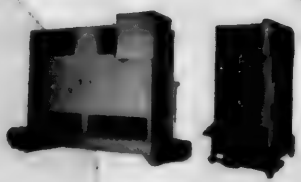

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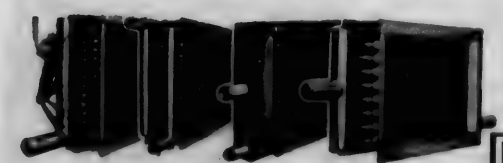

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## SOLAR FURNACE

(*Continued from page* 160)

is exposed to intense heat. Observers can watch the heating action through tinted glass and handle the test material after it is removed with a vise-like arm. The high temperatures are achieved so quickly that some twenty experiments can be made in half an hour.

Besides determining the melting and boiling points of several materials, the chemist plans to study other properties at various temperatures.

The world's first solar furnace was built in Jena, Germany, in 1924. Dr. Laszlo said he knew of only two in operation today, one in Montlouis, France, the other used in research for private industry in San Diego.

## DRUMLESS BOILER

**for Dayton utility will be first once-through unit to operate in sub-critical range in U. S.**

An innovation in American power practice was disclosed in a recent announcement of the Dayton Power & Light Company, Dayton, Ohio, that it has placed a contract with Combustion Engineering, Inc., New York, for a C-E Sulzer Monotube Steam Generator.

Although this is the second C-E Sulzer Unit to be ordered in this country, it will be the first of the "once-through" type to operate at a steam pressure in the "sub-critical" range and will be larger than any such unit elsewhere.

• **HIGHEST.**—The previous unit, ordered last year by Philadelphia Electric Company, is designed for the "super-critical" pressure of 6000 psig —the highest steam pressure adopted to date anywhere in the world. The steam temperature for this unit, 1200 deg F, also establishes a new world record. Only one other "super-critical" pressure boiler has thus far been ordered in America, and there are none installed abroad.

Although the Dayton installation will be the first "once-through" boiler in this country for conventional pressure, there are a large number of such installations in Europe where metal shortages and other factors have favored the use of such boilers.

# BOOK REVIEWS

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PERMISSIBLE DUSTINESS—In the American Industrial Hygiene Association Quarterly for March, 1955, there is a paper on Permissible Dustiness, by Theodore Hatch, Graduate School of Public Health, University of Pittsburgh. This article is now available as a reprint and may be obtained free by writing to the Industrial Hygiene Foundation, 4400 Fifth Avenue, Pittsburgh 13, Pa.

RING JOINT GASKETS AND GROOVES—The American Society of Mechanical Engineers announces the publication of the revised American Standard Ring Joint Gaskets and Grooves for Steel Pipe Flanges (ASA B16.20-1955). This standard covers types and sizes, materials, dimensions, tolerances and finish, identification numbers and marking. The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price $1.

WATER TREATMENT SPECIFICATIONS—Suggested specifications are presented to cover the treament of water for air conditioning systems, water pipes in buildings, steam heating boilers, industrial steam boilers, hot water heating systems. Each part describes the water treatment service, the kind of chemical feeding device needed and the qualifications required by the water treatment contractor. There are also suggested clauses to be included in the specifications for the system and detailed drawings of the required equipment. Water Service Laboratories, Inc., 423 West 126th Street, New York 27, N. Y.

ASTM STANDARDS IN BUILDING CODES—More than 250 specifications, methods of tests and definitions of materials included in the major building codes of the United States and Canada have been brought together by the American Society for Testing Materials in one publication. The standards in this book cover the full range of construction materials including structural and reinforced steel, steel, cast iron and copper pipe, ready-mixed concrete and many other materials. It is planned to compile supplements as the need develops to this publication each year similar to those prepared for the Book of ASTM Standards. This publication has a page size of 6 x 9 inches and contains 973 pages. American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. Price $6.

# COMING EVENTS

**Where listed, names or titles of individuals are those from whom further information is available.**

**AIEE MEETING**—Pacific general meeting of the American Institute of Electrical Engineers, at the Finlen Hotel, Butte, Mont. Secretary of the Institute, 33 West 39th St., New York 18, N. Y. . . . . **AUGUST 15-18, 1955.**

**INTERNATIONAL CONGRESS OF REFRIGERATION**—Ninth International Congress of Refrigeration, sponsored by the International Institute of Refrigeration, to be held in the conference rooms of the Sorbonne in Paris, France. General Secretariat of the Congress, International Institute of Refrigeration, 177, Boulevard Malesherbes, Paris, France . . . . . **AUGUST 31-SEPTEMBER 15, 1955.**

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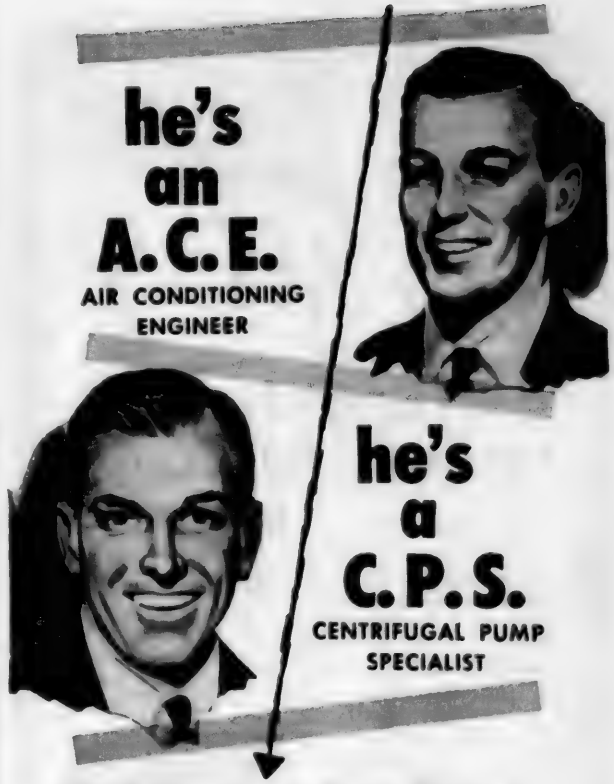


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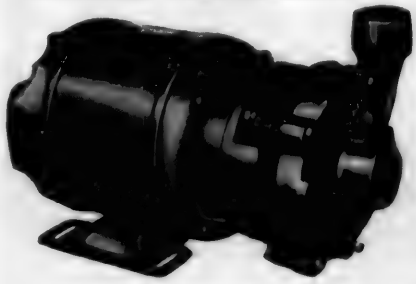

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**PRODUCTION ENGINEERING SHOW**—First Production Engineering Show of a new series of annual expositions, to be held at Navy Pier, Chicago, Ill. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. . . . . **SEPTEMBER 6-16, 1955.**

**INSTRUMENT SOCIETY CONFERENCE**—Tenth Annual Conference and Exhibit of the Instrument Society of America, to be held at Shrine Exposition Hall and Shrine Auditorium, Los Angeles, Calif. John McCaffery, assistant executive secretary of the Society, 1319 Allegheny Ave., Pittsburgh 33, Pa. . . . . **SEPTEMBER 12-16, 1955.**

**WHOLESALE PLUMBING AND HEATING CONVENTION**—4th annual convention of the American Institute of Wholesale Plumbing and Heating Supply Associations, Inc., to be held at the Hotel Waldorf-Astoria, New York, N. Y. G. T. Underwood, executive secretary of the Institute, 402 Albee Building, 1426 G St., N. W., Washington, D. C. . . . . **SEPTEMBER 17-21, 1955.**

**ASME MEETING**—Annual meeting of the American Society of Mechanical Engineers, at Roosevelt Hotel, New Orleans, La. Secretary of the Society, 29 W. 39th St., New York, N. Y. . . . . **SEPTEMBER 25-29, 1955.**

**GAMA MEETING**—Annual meeting of the Gas Appliance Manufacturers Association, at the El Mirador, Palm Springs, Calif. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York,. N. Y. . . . . **OCTOBER 12-14, 1955.**

**AGA CONVENTION**—1955 convention of the American Gas Association and the Pacific Coast Gas Association, at the Statler Hotel, Los Angeles, Calif. Secretary of the AGA, 420 Lexington Ave., New York 17, N. Y. . . . . **OCTOBER 17-19, 1955.**

**ASA MEETING**—Annual meeting of the American Standards Association, at the Sheraton Park Hotel, Washington, D.C. Secretary of the Association, 70 E. 45th St., New York 17, N. Y. . . . . **OCTOBER 24-26, 1955.**

**SOLAR ENERGY SYMPOSIUM**—A World Symposium on Applied Solar Energy, sponsored by Stanford Research Institute, Stanford, Calif., to be held at Phoenix, Ariz. Chairman of the Institute, 612 S. Flower St., Room 332, Los Angeles 14, Calif. . . . . **NOVEMBER 1-5, 1955.**

**ASME MEETING**—75th anniversary meeting of the American Society of Mechanical Engineers, at the Hilton and Blackstone Hotels, Chicago, Ill. Secretary of the Society, 29 W. 39th St., New York, N. Y. . . . . **NOVEMBER 13-18, 1955.**

**POWER EXPOSITION**—Chicago Exposition of Power & Mechanical Engineering, at the Coliseum, Chicago, Ill., to be held under the auspices of The American Society of Mechanical Engineers, in conjunction with their 75th Anniversary meeting. E. K. Stevens, manager, International Exposition Co., Inc., 480 Lexington Ave., New York, N. Y. . . . . **NOVEMBER 14-18, 1955.**

**CHEMICAL ENGINEERS MEETING**—Annual meeting of American Institute of Chemical Engineering, at the Statler Hotel, Detroit, Mich. Secretary of the Intsitute, 29 W. 39th St., New York 18, N. Y. . . . . **NOVEMBER 27-30,1955.**

**REFRIGERATION EXPOSITION**—9th Exposition of the Air-Conditioning and Refrigeration Industry, at Atlantic City, N. J., sponsored by the Air-Conditioning and Refrigeration Institute. The name of this trade show, formerly known as the All-Industry Refrigeration and Air Conditioning Exposition, has been officially changed. George Jones, executive secretary of the Institute, 1346 Connecticut Ave., N. W., Washington, D. C. . . . . **NOVEMBER 28—DECEMBER 1, 1955.**

**WARM AIR CONVENTION**—42nd annual convention of the National Warm Air Heating and Air Conditioning Association, at Hotel Statler, New York, N. Y. Managing Director of the Association, 640 Engineers Building, Cleveland 14, Ohio. . . . . **NOVEMBER 30-DECEMBER 1, 1955.**

**ASRE ANNUAL MEETING**—51st annual meeting of the American Society of Refrigerating Engineers, at the Traymore Hotel, Atlantic City, N. J. R. C. Cross, secretary of the Society, 234 Fifth Ave., New York 1, N. Y. . . . . **DECEMBER 1-3, 1955.**

**CHEMICAL INDUSTRIES EXPOSITION**—25th exposition of Chemical Industries, at Commercial Museum and Convention Hall, Philadelphia, Pa. E. K. Stevens, manager, International Exposition Co., 480 Lexington Ave., New York 17, N. Y. . . . . **DECEMBER 5-9, 1955.**

**ATOMIC EXPOSITION**—1955 Atomic Exposition, sponsored by American Institute of Chemical Engineers, at Municipal Auditorium and Annexes, Cleveland, Ohio. A. F. Denham, director of Atomic Exposition Management, 931 Book Building, Detroit 26, Mich. . . . . **DECEMBER 10-16, 1955.**

**NUCLEAR CONGRESS**—Nuclear Congress and Atomic Exposition, sponsored by the Engineers Joint Council, to be held in Cleveland, Ohio. Stewart E. Reimel, secretary of the Council, 29 W. 39th St., New York 18, N. Y. **DECEMBER 12-17, 1955.**

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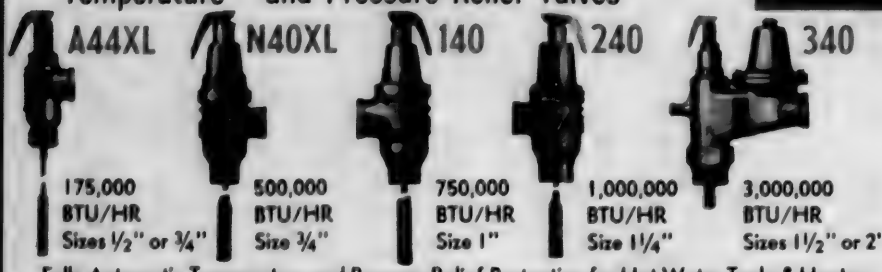

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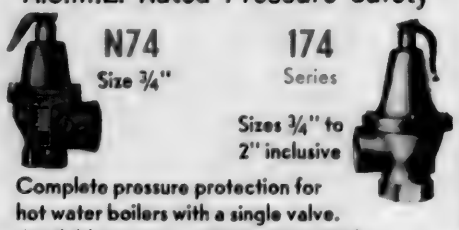

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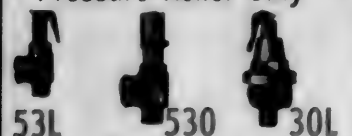

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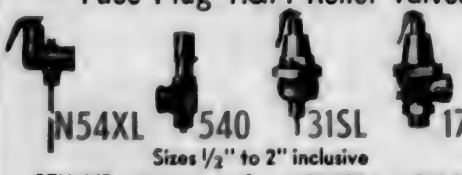

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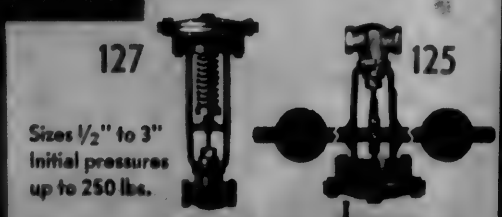
Reduced pressures 5 to 100 lbs.

## Water or Air Pressure Regulation

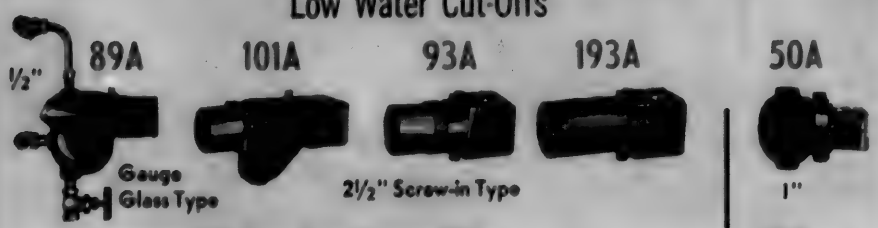
| **135** | **223** | **26** | **57** |
|---|---|---|---|
| Sizes ½" to 2" | ½" to 2" | ⅛", ¼", ⅜" | ⅛", ¼" |
| Initial Pressure | 250 lbs. | 300 lbs. | 200 lbs. |
| Reduced Pressures | 30 to 75 lbs. | 1 to 175 lbs. | 1 to 75 lbs. |



**127** — Sizes ½" to 3" Initial pressures up to 250 lbs. — Reduced pressures 10 to 100 lbs.

**125** — 1 to 15 lbs.

## Low Water Cut-Offs



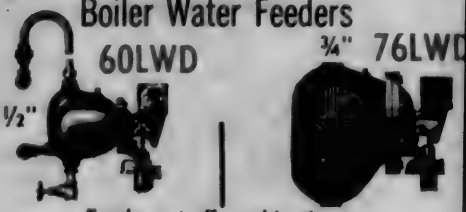
**89A** ½" — Gauge Glass Type

**101A** — **93A** — **193A** — 2½" Screw-in Type

Maximum Steam Pressure 25 lbs.

**50A** — 1" — 50 lbs.

## Boiler Water Feeders



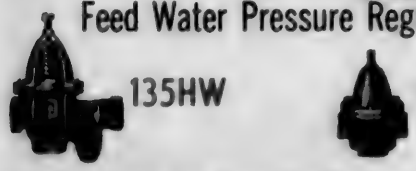
**60LWD** ½"

**76LWD** ¾"

Feeder cut-off combinations

| Sq. Ft. Radiation | |
|---|---|
| up to 5,000 | over 5,000 |

## Feed Water Pressure Regulators — Check Valve Strainer

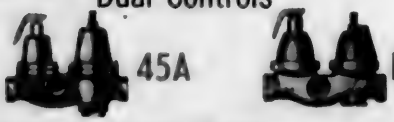


**135HW** — Feeds water to boiler at 10 to 15 lbs.

**N39**

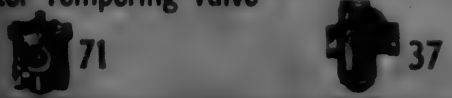
**37C** — Prevents water from backing out of boiler.

## Dual Controls



**45A** — **N45** — Feeds water to boiler at 12 lbs. Pressure relief at 30 lbs.

## Water Tempering Valve



**71** — **37**

## Strainers

**34**

## Vacuum Relief Valve

**188** — **36**

Siphon Vacuum Breaker

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# AIR CONDITIONING ESTIMATING DATA

It is frequently desirable to have at hand estimating data for use especially in working up preliminary figures. The following unit data on air conditioning were compiled by Gayle B. Priester, Air Conditioning Engineer, Consolidated Gas, Electric Light and Power Company of Baltimore.

From the large number of air conditioning installations that have already been made, sufficient operating data are available for arriving at general figures (Table 1) for classes of commercial installations. The information is not intended to replace the careful heat gain calculations necessary in a particular air conditioning design. These data, however, do enable an engineer to obtain a broad general picture with reference to the areas and number of persons generally served, the range of size of unit commonly installed for such service, and the required power consumption. These data can also be used as check figures to substantiate particular design calculations.

The information was obtained from analyses of actual load estimates and from other sources. In most cases, outside design conditions were 95F dry bulb and 75 or 78F wet bulb; inside design conditions were 76 to 80F dry bulb and 50% relative humidity.

When the watts per square foot are higher than average, or the square feet per person are lower than average, the total load usually is higher than average.

Since people, lights, and outside air usually account for the greatest part of the cooling load, except for living quarters or industrial applications, the data in Table 2 are given to show the important effect that a change in these items has on the total cooling load.

For the average application, approximately 1 hp per ton of refrigeration is required for the refrigerant compression equipment. When the predominant load is due to people, as in theaters and taverns, a lower refrigerant temperature is required to remove the high latent heat load caused by moisture from the occupants. Therefore, more than 1 hp per ton is required. Similarly, when a large part of the cooling load is sensible heat due to transmission, solar radiation, or lights, a higher refrigerant temperature can be used and less than 1 hp per ton is needed. The supply air fan power requirement is about 0.1 hp per ton of refrigeration.

Table 3 gives electric power consumption data

**Table 1. Design Data for Commercial Air Conditioning**

| Application | Btu per Hr per Sq Ft | | | Persons per Ton | | | Cfm per Sq Ft | | | Sq Ft per Person | | | Watts per Sq Ft | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Avg. | High | Low | Avg. | High | Low | Avg. | High | Low | Avg. | High | Low | Avg. | High |
| Apartments and hotel guest rooms | 13 | 20 | 30 | 1.4 | 1.7 | 2.2 | 0.5 | 0.7 | 0.9 | 100 | 175 | 325 | 0.2 | 0.6 | 0.9 |
| Art museums, libraries | 30 | 51 | 75 | 2.5 | 4.3 | 8.3 | 0.9 | 1.6 | 2.1 | 40 | 60 | 80 | 0.5 | 1.0 | 2.0 |
| Bank areas | 35 | 53 | 75 | 2.5 | 4.7 | 7.5 | 1.1 | 1.8 | 2.5 | 26 | 53 | 80 | 0.9 | 2.9 | 4.4 |
| Barber shops | 45 | 73 | 112 | 2.9 | 4.9 | 7.4 | 1.3 | 2.6 | 4.4 | 20 | 40 | 60 | 0.6 | 1.4 | 4.6 |
| Beauty shops | 49 | 75 | 114 | 2.5 | 4.3 | 7.1 | 1.6 | 2.3 | 3.0 | 17 | 42 | 75 | 2.7* | 4.2* | 9.3* |
| Clothing stores, children's | 39 | 41 | 42 | 1.4 | 3.1 | 5.9 | 1.1 | 1.8 | 3.2 | 48 | 96 | 130 | 1.1 | 1.6 | 2.5 |
| Clothing stores, men's | 33 | 45 | 85 | 1.2 | 3.0 | 6.2 | 0.9 | 1.4 | 1.8 | 60 | 118 | 205 | 1.0 | 2.2 | 4.4 |
| Clothing stores, women's | 30 | 43 | 65 | 2.5 | 5.7 | 11.0 | 0.8 | 2.4 | 6.9 | 22 | 61 | 107 | 0.8 | 3.3 | 7.4 |
| Clothing stores, general | 29 | 44 | 68 | 3.2 | 5.2 | 7.0 | 0.9 | 1.4 | 2.1 | 27 | 65 | 111 | 1.5 | 2.3 | 3.5 |
| Department store basements | 20 | 30 | 39 | 6.2 | 8.0 | 15.0 | 0.5 | 0.8 | 1.2 | 20 | 30 | 95 | 0.8 | 2.4 | 3.9 |
| Department stores, main floors | 25 | 42 | 62 | 2.0 | 6.0 | 7.0 | 0.9 | 1.3 | 2.0 | 16 | 35 | 90 | 0.7 | 2.5 | 5.2 |
| Doctors' and dentists' offices | 35 | 51 | 68 | 1.3 | 4.0 | 7.0 | 1.2 | 1.7 | 2.4 | 29 | 75 | 160 | 1.4 | 1.7 | 3.4 |
| Drug stores | 35 | 70 | 109 | 1.3 | 4.5 | 6.9 | 1.1 | 1.9 | 3.4 | 17 | 39 | 92 | 0.2 | 1.6 | 3.9 |
| Food stores | 44 | 82 | 142 | 3.0 | 5.3 | 7.9 | 1.3 | 2.5 | 4.8 | 12 | 36 | 72 | 0.9 | 2.6 | 5.0 |
| Offices, private and general | 22 | 43 | 72 | 1.2 | 3.5 | 6.3 | 0.7 | 1.4 | 2.2 | 32 | 105 | 278 | 0.6 | 2.0 | 4.8 |
| Restaurants | 62 | 115 | 260 | 3.4 | 7.0 | 11.1 | 0.8 | 2.1 | 3.8 | 9 | 18 | 32 | 0.2 | 1.4 | 6.8 |
| Specialty stores | 22 | 52 | 179 | 1.1 | 3.1 | 5.5 | 0.8 | 1.9 | 5.9 | 20 | 90 | 192 | 0.9 | 3.9 | 12.9 |
| Taverns and night clubs | 25 | 80 | 165 | 6.6 | 8.6 | 10.7 | 0.8 | 1.4 | 2.8 | 8 | 18 | 75 | 0.2 | 1.1 | 2.2 |
| Theaters | 74 | 92 | 115 | 10.4 | 16.0 | 19.0 | 15.0† | 20.0† | 30.0† | 6 | 8 | 12 | 0.1 | 0.3 | 0.8 |

* For lights and equipment.

† Cfm dehumidified air per person.

**Table 2. Cooling Load Calculations**

| Application or Item | Btu per hr = (1) × (2) | |
|---|---|---|
| | Quantity (1) | Factor (2) |
| Theaters | No. persons | 350 |
| Quiet offices or living quarters | No. persons | 400 |
| Active offices or retail stores | No. persons | 450 |
| Drug stores or restaurants | No. persons | 500 |
| Lights | Watts on in room | 3.4 |
| Outside air (at 95F db and 78F wb) | cfm | 43 |

based on actual installations analyzed for 95F dry bulb and 78F wet bulb conditions at about 40 deg latitude and near sea level. For different conditions and length of cooling season, these figures would have to be adjusted accordingly. Spaces are left to insert comparable figures for a local territory. Equivalent full load operating hours are included.

In addition to electric power costs, there usually are water costs. If a water-cooled condenser is used, then from 1 to 2 gpm of water per ton of refrigeration are required. The colder the water, the less refrigeration tonnage is needed. The total water consumption cost for the season would be obtained by multiplying the total cooling load in tons by the operating hours from Table 3 times an average figure of 1.5 gpm times 60 minutes per hour times the cost per gallon (7.5 gal = 1 cu ft). In other words,

Average water cost = tons cooling load × hours × 1.5 × 60 × cost of water per gal

or

= tons × hours × 12 × cost of water per cu ft

Where restrictions on the use of water exist or where water is expensive, a water-cooling tower or an evaporative type refrigerant condenser should be used. These require about 10% more connected electric load and power consumption, but reduce the water consumption by at least 90%.

The installation cost of most air conditioning systems ranges from $300 to $1,000 per ton, the average cost varying for different applications and different localities. The cost per sq ft of floor area varies from about $1 to $4.

When air conditioning is not practical, some means of ventilation is necessary, particularly in the summer, to prevent the heat and odors in a space from accumulating and becoming objectionable, or to remove smoke and vapors.

Roughly, 1 hp per 9,000 to 18,000 cfm is required by a direct-driven propeller fan with free delivery. The actual value depends upon the fan design and operating speed. One hp per 3,000 to 6,000 cfm is required under reasonable conditions for a blower operating against ½ inch static pressure. Noise must be considered in many cases, and a large enough fan must be selected to deliver air quietly.

**Table 3. Power Consumption Data for 2 Consecutive Years**

| Installation | | Hp Range | Annual Kwhr per Hp | | | Equiv. Full Load Operating Hours | |
|---|---|---|---|---|---|---|---|
| No. Used | Class | | Range | 2-Yr Avg. | Local | Avg. | Local |
| 9 | Restaurants | 12–36 | 850–1,870 | 1,425 | | 1,620 | |
| 4 | Cafeterias | 11–21 | 770–1,365 | 1,124 | | 1,270 | |
| 15 | Drug stores | 3–13 | 516–2,101 | 1,021 | | 1,160 | |
| 5 | Jewelry stores | 5–9 | 565–1,180 | 840 | | 950 | |
| 8 | Night clubs | 15–47 | 410–1,190 | 827 | | 940 | |
| 9 | Dress shops | 5–45 | 354–1,085 | 770 | | 870 | |
| 11 | Residences | 3–11 | 111–1,229 | 661 | | 750 | |
| 11 | Theaters | 35–60 | 327–1,300 | 618 | | 700 | |
| 4 | Large offices | 45–60 | 490–1,018 | 547 | | 620 | |
| 7 | Ten-cent stores | 40–140 | 344–978 | 527 | | 600 | |
| 6 | Shoe stores | all 3.5 | 270–782 | 526 | | 600 | |
| 7 | Beauty shops | 5–8 | 287–745 | 510 | | 580 | |
| 4 | Small offices | all 5.5 | 264–580 | 441 | | 500 | |
| 6 | Recreation spaces | 25–65 | 276–651 | 421 | | 480 | |
| 9 | Funeral parlors | 10–18 | 108–572 | 187 | | 210 | |

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